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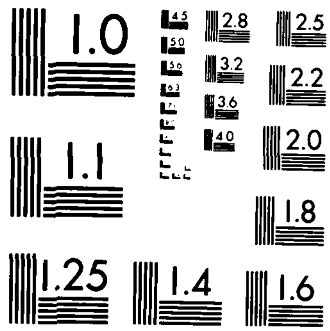

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Report No. 2

BIBLIOGRAPHY ON TIDAL HYDRAULICS

Supplement No. 9

Supplementary Material
Compiled from June 1980 to June 1983

Tidal Flows in Rivers and Harbors

June 1985

Committee on Tidal Hydraulics
CORPS OF ENGINEERS, US ARMY

PRESENT MEMBERSHIP OF

COMMITTEE ON TIDAL HYDRAULICS

PREFACE

Report No. 2, "Bibliography on Tidal Hydraulics," and Supplements No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, No. 7, and No. 8 thereto were published by the Committee on Tidal Hydraulics in 1954, 1955, 1957, 1959, 1965, 1968, 1971, 1975, and 1980, respectively, in connection with certain of its objectives. Additional references on the subject, either published since 1980 or not available at that time, have been accumulated for the present supplement. This supplement consists of approximately 440 references, all of which are available for loan, within the continental United States, from the Library Branch, US Army Engineer Waterways Experiment Station (WES).

The supplement follows the same form as the original bibliography and consists of eight sections, each preceded by a brief statement of its scope. As a further convenience to the user, the references are arranged alphabetically under each subject-matter heading (section) and all have been annotated. Although the majority of the references appear in more than one section, the complete entry appears only once--under the most applicable subject heading--with other listings giving only author, title, and key for its location.

Copies of this and other reports of the Committee may be obtained from the Committee on Tidal Hydraulics, care of US Army Engineer Waterways Experiment Station (ATTN: WESTP), PO Box 631, Vicksburg, Mississippi 39180.

This supplement was compiled by Katherine M. Kennedy and Alfrieda S. Clark, Special Projects Branch, Technical Information Center, WES.

Commanders and Directors of WES during the compilation and publication of this supplement were COL Tilford C. Creel, CE, and COL Robert C. Lee, CE. Technical Director was Mr. F. R. Brown.

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CONTENTS

SECTION I. THEORETICAL CONSIDERATIONS

Basic principles of tidal hydraulics, including the mechanics and types of tides, height and time of tide, tide-producing forces, tidal currents, theories, cubature techniques, predictions, computations, estuarine circulation, and meteorological effects.

Abbott, M.B. The Application of Design Systems to Problems of Unsteady Flow in Open Channels. In: Proceedings of the International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle Upon-Tyne, England, April 12-15, 1976, E1-1-E1-14.

The design system is an ensemble of mutually compatible routines organized into a single program documentation entity capable of supplying solutions to any one of a set of problems when presented only with the specific problem description. Through the use of these systems it is possible to solve problems of unsteady open-channel flow much more quickly, accurately, and cheaply than is possible with one-off mathematical models. The design systems S11 'Siva,' S21 'Jupiter,' and S12/13 and S22/23 "Neptune' of the Computational Hydraulics Centre are described, together with a sketch of their development and fields of application. All these systems treat the extended equations of open channel flow, so including convective terms, and in all cases high-accuracy implicity difference schemes are used. The 'Siva' is used for one-dimensional water bodies of homogeneous density in any vertical such as rivers, fiords, and well-mixed estuaries. The 'Jupiter' is used for two-dimensional regions without stratification, such as more complex estuaries, coastal regions, and even open seas, while applications have also been made to floodings of initially dry regions, following the failure of dams or dykes. The special wind field, dissipation, and boundary routines of the 'Jupiter' are also outlined. The 'Neptune' is applied to stratified fluids. The influence of mathematical modelling technique on research and teaching is also mentioned. References (15 items).

Amin, M. A Note on Extreme Tidal Levels. INTERNATIONAL HYDROGRAPHIC REVIEW, 56(2): 133-141, July 1979.

A method of predicting extreme peaks of predominant semidiurnal tides on the basis of 'Highest Astronomical Tide' (HAT) is investigated. CARTWRIGHT's (1974) views and comments hold in general, but some variations are observed between the extreme physical tides and HAT's. These variations are understandably due to nonlinearities in the response function of phase lags. The constituents of frictional origin tend to minimize the range of extreme physical tides. The order of these marginally reduced levels at various near-extremes can be easily reversed by nonlinearities of the response function. Although extreme peaks follow the moon's perigee these extremes occur when the longitude of the moon's node is near autumn equinox. It appears to be impossible to specify a simple rule for absolute determination of extreme tidal levels, but if a tolerance in accuracy of a few centimetres is allowed then the method as presented can work adequately. References (2 items).

An, H.S. A Numerical Experiment of the N(2) Tide in the Yellow Sea. (See complete entry in Section VI.)

Anwar, H.O. A Study of the Turbulent Structure in a Tidal Flow. ESTUARINE, COASTAL AND SHELF SCIENCE, 13(4):373-387, October 1981.

Field measurements have shown that the unsteady phases of a tidal flow have a strong effect on the turbulent mechanism. Laboratory measurements were therefore undertaken to study this effect. The drag coefficient, roughness length, turbulent spectra of the horizontal, and vertical velocity fluctuations together with their product were determined from the measured data. Frequency distribution of the bursting events and the contributions of these events to the Reynolds shear stress, together with the duration of the events, were evaluated by taking measurements at various heights above the bed during the a celerating and decelerating phases of the flow. The results were compared with those obtained from measurements carried out on the Great Ouse estuary and with those obtained by other workers. References (23 items).

Anwar, H.O., and Atkins, R. Turbulence Measurements in Simulated Tidal Flow. Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY8): 1273-1289, August 1980.

Field measurements of tidal flow have shown that there is an increase in turbulent parameters (turbulent intensity, Reynolds stress, coefficient of turbulent diffusivity, and the rate of sediment transport) when the flow is decelerating as compared with when it is accelerating. A series of experiments were conducted to study the effect of unsteady flow on turbulence characteristics. The flow in a long flume was accelerated and then decelerated for the same periods of time. Instantaneous velocity components in three directions, water surface slope, and shear stress at bed were measured. From measured data mean velocity profiles, temporal and spatial Reynolds stress profiles, and energy spectra were determined. The results were compared, whenever possible, with those obtained from field measurements. References (19 items).

April, G.C., Ng, S., and Brett, C.E. Sediment Transportation and Deposition Models for Mobile Bay, Alabama. (See complete entry in Section II.)

Backhaus, J. First Results of a Three-Dimensional Model on the Dynamics in the German Bight. (See complete entry in Section VI.)

Bayliss-Smith, T.P., et al. Tidal Flows in Salt Marsh Creeks. ESTUARINE AND COASTAL MARINE SCIENCE, 9(3):235-255, September 1979.

Tidal flows in salt marsh creeks must control both creek morphology and the overall sediment and nutrient budgets of the marsh, but little is known of the magnitude and frequency of such flows. Data are presented in the paper from north Norfolk, England, which indicate a threefold division of the tidal-flow regime. On upper marshes the majority of tides are below-marsh and apart from a small initial pulse of velocity on the flood, they generate only modest flows in creeks. The level of the marsh surface provides a threshold at which, with higher marshfull tides, velocities can increase to reach peaks shortly before and

shortly after high tide. These velocity pulses are greater in the ebb than on the flood, but the flood pulse occurs at a higher stage. The even higher but infrequent over-marsh tides, often associated with storm surges, have a substantial flood maximum in both velocity and discharge. It is hypothesized that only these extreme tides might be capable, on upper marshes, of achieving significant erosion and deposition, and that their much higher frequency on lower marshes may account for the observed rapidity of geomorphic change at this earlier stage in salt marsh development. References (38 items).

Beauchamp, C.H., and Spaulding, M.L. Tidal Circulation in Coastal Seas. In: Verification of Mathematical and Physical Models in *Hydraulic Engineering; Proceedings, 26th* Annual Hydraulics Division Specialty Conference, University of Maryland, College Park, Maryland, August 9-11, 1978. New York, 1978, 518-528.

An application of Leendertse's multioperational finite difference scheme for solution to the two-dimensional, vertically integrated momentum and continuity equations has been made for tidal circulation in Long Island Sound, Block Island Sound, Rhode Islands Sound, and Buzzards Bay. The circulation within the modeled region is predominantly forced by specification of tidal elevation along the large open boundary separating the system from New England shelf waters. The model was calibrated by comparing phase and range of tidal elevations obtained from the simulations with those measured at 46 locations within the modeled region. References (15 items).

Bell, P.R., et al. Measurement and Analysis of the Effects of Stormwater on the Lane Cove Estuary. (See complete entry in Section IV.)

Bennett, J.P. Calibration of Branched Estuary Models. (See complete entry in Section VI.)

Blackford, B.L. On the Generation of Internal Waves by Tidal Flow over a Sill: A Possible Nonlinear Mechanism. JOURNAL OF MARINE RESEARCH, 36(3):529-549, 1978.

The generation of internal waves in a two-layer tidal channel containing a sill is considered. The distorted free surface associated with the locally accelerated tidal flow in the vicinity of the sill is assumed to be the driving forcing for internal waves. A simplified, nonrigorous model, which incorporates this forcing mechanism, is developed and predicts that internal waves should be generated at twice the tidal frequency as well as at the tidal frequency. The amplitude of the component at twice the tidal frequency is predicted to vary as the square of the amplitude of the surface tide over the sill. The model also predicts a steady component of elevation of the internal interface in the vicinity of the sill. The model predictions are compared to field observations from two natural fjord systems and also to experimental data from a laboratory wave tank experiment. The agreement between theory and experiment is encouraging. References (13 items).

Blanton, J.O. The Transport of Freshwater off a Multi-Inlet Coastline. In: Estuarine and Wetland Processes, with Emphasis on Modeling. Edited by Peter Hamilton and K.B. Macdonald. New York, Plenum Press, 49-64, 1980.

The inner continential shelf waters between South Carolina and northern Florida are weakly stratified by the many sources of fresh water ejected from the land. The mixing of fresh water in this zone is qualitatively similar to that in a particularly mixed estuary. However, many inlets along the coast result in a complex *orientation to the principal axes of* the tidal currents offshore and the resulting mixing processes are nonhomogeneous in the alongshore direction. These complexities must be faced in any realistic model of similar oceanic regions. Data are presented to show the nature of the nonhomogeneous transport process and to demonstrate that models which neglect alongshore gradients of momentum and properties are unrealistic. References (6 items).

Blumberg, A.F. On the Dynamic Balance of the Chesapeake Bay Waters. (See complete entry in Section VI.)

Boicourt, W.C. Circulation in the Chesapeake Bay Entrance Region: Estuary-Shelf Interaction. (See complete entry in Section VII.)

Bokuniewicz, H.J., et al. Field Study of the Effects of Storms on the Stability and Fate of Dredged Material in Subaqueous Disposal Areas. (See complete entry in Section II.)

Bonnefille, R. Present State of Knowledge: The Physical Behaviour of an Estuary and Its Implication on Estuary Dynamics. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 1-2, 1973.

The hydrodynamical behavior of an estuary is extremely intricate because it is the meeting area of the salt sea water and the turbide fresh water flowing from rivers. It is generally a shoaling zone of low depth where the bottom is sand or mud. Because of the economical importance of estuaries as an inland way of penetration of vessels, the improvement of their navigation channel is a modern problem. Estuaries are also interesting zones to install big power stations, because they offer opportunities for the building of large cooling systems. Estuaries are very important from the environmental point of view, and consequently they are to be handled carefully. References (1 item as a footnote).

Bouma, A.H., et al. Bedform Characteristics and Sand Transport in a Region of Large Sand Waves, Lower Cook Inlet, Alaska. (See complete entry in Section II.)

Bouma, A.H., et al. Large Dunes and Other Bedforms in Lower Cook Inlet, Alaska. (See complete entry in Section II.)

Bowden, K.F. Turbulent Mixing in Estuaries. OCEAN MANAGEMENT, 6(2/3):117-135, January 1981.

The pattern of flow in a tidal estuary is largely determined by the vertical transport

of momentum and density due to turbulence. In a well-mixed estuary the turbulent mixing throughout the depth is dominated by turbulence associated with friction at the bed, although the effect of shear at middepth due to the density driven residual flow is not necessarily negligible. The main features of the flow resemble those in boundary layer flows, on which much information is available from other branches of fluid mechanics. Similar methods of calculation may be used, based on a mixing length approach or a turbulent energy closure model. In a slightly stratified estuary the conditions are modified without being changed radically, but as the opposite extreme of a highly stratified estuary is approached the flow is better represented by two well-mixed layers, separated by a relatively thin shear layer in which there is a steep density gradient. This type of flow has received considerable attention in theoretical studies and laboratory experiments and the results have some application to estuarine flows. Recent work on the application of relevant concepts of fluid mechanics to flows in estuaries is reviewed and some suggestions made for lines of future research. In many tidal estuaries the position is complicated in that the flow may vary between well-mixed and stratified within a tidal cycle and attention should be given to the time-varying nature of the flow. Even if only the tidally averaged result of mixing is required, a knowledge of the changing physical processes is needed in order to parameterize their effects. References (29 items).

Bowden, K.F. Turbulent Processes in Estuaries. In: Estuaries, Geophysics and the Environment. Washington, DC, National Academy of Sciences, 46-56, 1977.

The flow in estuaries in nearly always turbulent, and this characteristic affects the mechanics of the flow and its dispersive effects. In one sense, therefore, all physical processes in estuaries could be described as turbulent. In this paper a more restricted view will be taken and those aspects considered in which the turbulent nature of the process is apparent and should be explicitly taken into account. References (19 items).

Bowden, K.F., and Ferguson, S.R. Variations with Height of the Turbulence in a Tidally-Induced Bottom Boundary Layer. Marine Turbulence; Proceedings, 11th International Liege Colloquium on Ocean Hydrodynamics, edited by Jacques C.J. Nihoul. Amsterdam, Elsevier Scientific Publishing Company, 259-286, 1980.

Turbulent fluctuations of velocity were measured in the bottom boundary layer at several sites in the eastern Irish Sea. The measurements were made using two-component electromagnetic flowmeters with a frequency response extending to 2 Hz. Signals from three sensors at heights of 50 cm, 100 cm, and 200-210 cm from the seabed have been analyzed to observe possible variations with height of the turbulence structure. The signals analyzed covered a range of mean flow velocitires, U , extending up to approximately 70 $cm.s^{-1}$, and included data obtained at different stages of the semidiurnal tidal cycle. The r.m.s. levels of the longitudinal (u) and vertical (w) components were well correlated with U at each height. The variations with height in the level of the u component were generally insignificant but the w component showed a slightly higher level at the uppermost sensor. The mean product $\overline{uw}$ correlated well with U^2 at each height, but the variability between estimates of $\overline{uw}$ was larger than any systematic variation with height. Although systematic variations with height of the mean values $\left(\overline{u^2}\right)^{1/2}$, $\left(\overline{w^2}\right)^{1/2}$ and $\overline{uw}$ were generally less than the variability at each height, some significant variations with height were observed in the spectral levels at different wave numbers. At low wave numbers ($\sim 2 \times 10^{-3}$ cm^{-1}) the w spectral level increased with height, whereas the u spectral levels were similar. At higher wave numbers ($\sim 2 \times 10^{-1}$ cm^{-1}) the spectral levels of both components decreased with increasing height. References (18 items).

Brink, K.H., Allen, J.S., and Smith, R.L. A Study of Low Frequency Fluctuations near the Peru Coast. JOURNAL OF PHYSICAL OCEANOGRAPHY, 8(6):1025-1041, November 1978.

An analysis is presented of low-frequency (>0.4 cpd) fluctuations in currents, temperature, and tide gage data collected during the March-September 1976 segment of the CUEA JOINT II experiment off the coast of Peru. The observations were made near 15° S, a region of particularly strong and persistent coastal upwelling. Conclusions about the dynamics of motions over the continental shelf and slope are reached by means of correlations, empirical orthogonal functions, and other indicators. It is found that flow over the shelf, where stratification was weak, was generally dominated by vertical turbulent frictional effects and was strongly coupled to the effectively inviscid, baroclinic flow over the slope. The momentum balance was three dimensional, with the alongshore pressure gradient playing an important role. In contrast to behavior in other coastal upwelling regions, the alongshore velocity field over the shelf and slope was evidently not strongly driven by the local alongshore component of the wind stress. The mean wind stress throughout the period was equatorward (upwelling favorable) whereas the mean alongshore currents over the shelf were poleward. The alongshore current fluctuations, which propagated poleward along the coast, were initially poorly correlated with the local wind stress, but during the course of the experiment, the wind stress increased in magnitude and gained in importance as a driving mechanism. The temperature and onshore-offshore current fluctuations over the shelf and, therefore, presumably the upwelling circulation were, however, correlated with the local wind stress throughout the experiment. References (28 items).

Brocard, D.N., and Hsu, S.-K. Mathematical Modeling of Heated Surface Discharge in Confined Tidal Estuary: Mercer Generating Station. (See complete entry in Section IV.)

Brocard, D.N., Hsu, S.-K., and Walker, C. Mathematical Modeling of Heated Surface Discharge in Confined Tidal Estuary, Ravenwood Generating Station. (See complete entry in Section IV.)

Brockmann, C., et al. The Tidal Stream in the German Bight. (See complete entry in Section VI.)

Brown, R.D. Validation of Ocean Tide Models from Satellite Altimetry; Interim Progress Report, May-October 1978. (See complete entry in Section VII.)

Bruun, P. Design of Tidal Inlets on Littoral Drift Shores. (See complete entry in Section II.)

Busby, M.W., and Darmer, K.I. A Look at the Hudson River Estuary. WATER RESOURCES BULLETIN, 1970, 6(5):802-812.

The effect of tide waves on water movement in the Hudson River estuary is discussed. Computations based on records from three continous stage recorders and current-meter discharge measurements made throughout a tidal cycle show that peak discharge rates in the estuary at Poughkeepsie may be as great as 500,000 cubic feet per second and that total daily tidal volumes as great as 20 billion cubic feet move in the estuary. Computation of water movement in the estuary requires precise field data, and the data-collection system and computation procedure need to be perfected to adequately define water movement in the Hudson estuary. References (3 items).

Butler, H.L. Numerical Simulation of Tidal Hydrodynamics, Great Egg Harbor and Corson Inlets, New Jersey. (See complete entry in Section V.)

Campbell, J.W., and Thomas, J.P., eds. Chesapeake Bay Plume Study: Superflux 1980. (See complete entry in Section VII.)

Cartwright, D.E. Oceanic Tides. INTERNATIONAL HYDROGRAPHIC REVIEW, 55(2):35-84, July 1978.

The definition of the tide-generating potential, basic to all research, is reviewed in modern terms. Modern usage in analysis introduces the concept of tidal "admittance" functions, though limited to rather narrow frequency bands. A "radiational potential" has also been found useful in defining the parts of tidal signals which are due directly or indirectly to solar radiation. Laplace's tidal equations (LTE) omit several terms from the full dynamical equations, including the vertical acceleration. Controversies about the justification for LTE have been fairly well settled by Miles' (1974) demonstration that, when regarded as the lowest order internal wave mode in a stratified fluid, solutions of the full equations do converge to those of LTE. Solutions in basins of simple geometry are reviewed and distinguished from attempts, mainly by PROUDMAN, to solve for the real oceans by division into elementary strips, and from localized syntheses as used by MUNK for the tides off California. References (131 items).

Cartwright, D.E., et al. On the St. Kilda Shelf Tidal Regime. (See complete entry in Section VIII.)

Chatwin, P.C. Presentation of Longitudinal Dispersion Data. Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY1):71-83, January 1980.

It is proposed that deviations from Gaussianity of observed profiles of the concentration of a solute in a cloud as it passes the measuring station in a river, estuary, or similar flow should be explicitly measured by recording the nondimensional skewness and kurtosis. Examples of applications of the proposal are examined. It is shown that observed profiles can be fitted well by Edgeworth series provided the skewness and kurtosis are not too large. Review of the way in which different causes of deviations from Gaussianity can be classified in terms of the evolution of the skewness and kurtosis with downstream position is given, and it is argued that this is the most important point of the proposal. References (25 items).

Chopra, K.P. Thermally-Induced Air and Water Circulations in Estuarine Rivers. ESTUARINE AND COASTAL MARINE SCIENCE, 11(3):353-357, September 1980.

A physical theoretical model is proposed to explain and predict thermally induced air and water circulations introduced by contrasts in surface temperatures over an estuarine water and the adjoining land masses. Depending on the magnitude of the temperature contrast and the friction coefficient, moderate to strong winds should develop across the main estuarine flow. Thermohaline cross-flow circulations in water are expected to accompany the solenoidal winds in air. References (6 items).

Christodoulou, G.C., and Connor, J.J. Dispersion in Two-Layer Stratified Water Bodies. (See complete entry in Section VI.)

Chu, W-S., and Yeh, W.W-G. Two-Dimensional Tidally Averaged Estuarine Model. (See complete entry in Section VI.)

Chuang, W-S. Propagation and Generation of Internal Tides on the Continental Margin. Ph. D. Thesis, Johns Hopkins University, 1980.

The propagation of internal tide in the ocean is strongly affected by the effect of bottom topography and the effect of horizontal density stratification. In the particular case of a normal mode internal tide propagating into a region of linearly sloping, subcritical bottom plane and isopycnals, only the weak (discontinuous) solution can be constructed based upon the ray theory. It is shown that part of the incoming energy flux is induced upward along the characteristics at the sloping bottom and across the vertical line where the isopycnals change from level to upward inclination.

Collins, M., Ferentinos, G., and Banner, F.T. The Hydrodynamics and Sedimentology of a High (Tidal and Wave) Energy Embayment (Swansea Bay, Northern Bristol Channel). ESTUARINE AND COASTAL MARINE SCIENCE, 8(1):49-74, January 1979.

Swansea Bay may be taken as an example of an embayment which has a complex and variable hydrodynamic regime resulting from the interaction of its bathymetry and configuration with an adjacent rectilinear, semidiurnal tidal system and with superimposed oceanic swell and more locally generated seas. Eulerian tidal current observations in Swansea Bay indicated a coastal tidal current pattern which has developed from the main currents along the northern Bristol Channel. The observed pattern consists of an anticlockwise eddy in the western part of the embayment and a zone of divergence on the eastern side, between the eddy and the main offshore flow. Wave data, as represented by refraction diagrams and the distribution of sea bed orbital velocities, have demonstrated that high energy wave conditions prevail over the area. Sediment distribution and transport in Swansea Bay are controlled by tidally and wave-induced current patterns, but are also related to bathymetry and the exposure of relict deposits. However, evidence is presented to suggest that local dredging activities influence the sedimentation processes. References (47 items).

Costa, S.L., and Isaacs, J.D. The Modifications of Sand Transport in Tidal Inlets. (See complete entry in Section II.)

Crawford, W.R. Analysis of Fortnightly and Monthly Tides. THE INTERNATIONAL HYDROGRAPHIC REVIEW, 59(1):131-141, January 1982.

The fortnightly and monthly tidal constituents can be extracted from tidal records if care is taken in the analysis. One year of observations may be insufficient to resolve these constituents from the meteorologically forced background noise. This paper describes a procedure to reduce the background noise, and to determine the amplitude, phase, and uncertainties of these constituents. Analysis is performed on records from four ports in western Canada, at a latitude where air pressure changes and winds cause significant sea level changes. References (10 items).

Czerniak, M.T. Inlet Interaction and Stability Theory Verification. (See complete entry in Section II.)

Daddio, E., Wiseman, W.J., and Murray, S.P. Inertial Currents over the Inner Shelf near 30°N. JOURNAL OF PHYSICAL OCEANOGRAPHY, 8(4):724-733, July 1978.

Analysis of 2-month-long current records, one in February and one in May, from the inner shelf (28.9°N) west of the Mississippi River delta show strong oscillations in the diurnal-inertial frequency band. Lack of correlation of these currents with the predicted or measured tide and strong association with frontal passages suggest that they are wind-induced inertial oscillations. The observed oscillations are well reproduced by a time-dependent wind-driven model including Coriolis acceleration and friction. References (21 items).

Daly, M.A., and Mathieson, A.C. Nutrient Fluxes Within a Small North Temperate Salt Marsh. (See complete entry in Section IV.)

Davies, A.M., and Flather, R.A. Computation of the Storm Surge of 1 to 6 April 1973 Using Numerical Models of the North West European Continental Shelf and the North Sea. (See complete entry in Section VI.)

Davies, A.M., and Furnes, G.K. Observed and Computed M_2 Tidal Currents in the North Sea. (See complete entry in Section VI.)

DeAlteris, J., et al. The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey. In: Proceedings, 25th Annual Hydraulics Division Specialty Conference on Hydraulics in the Coastal Zone, New York, ASCE, 1977, 82-89.

The response of the southern New Jersey coastal waters to three types of meteorological events is described using observations of currents, waves, and tides. During summer doldrums, harmonically predictable tidal currents account for up to 80% of the energy in the current data. The influence of Delaware Bay mouth results in an amplification of the tidal currents in the southern portion of the study area. The transient response of the nearshore waters to a March Northeaster and Hurricane Belle is documented. In both cases, tidal currents were totally masked by an intense barotropic coastal jet generated by the wind stress.

Dierckx, P., et al. A New Method of Cubature Using Spline Functions. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 34(2):61-79, August 1981.

A new method for cubature calculations is presented. Spline approximations are constructed for the discharge variations in the different rivers of a tidal region. Derived quantities as ebb- and flood-volumes can be evaluated in a simple way. A computer program based on this method is described. Some results for the basin of the Schelde are shown. References (13 items).

Dietrich, G., et al. General Oceanography, an Introduction, 2d ed, New York, John Wiley, 626p, 1980.

This second English edition of General Oceanography is a translation from the third edition of the Allgemeine Meereskunde, which was completely rewritten by Dietrich and his coauthors in the early seventies and published in 1975. The material is presented in 10 chapters. Chapter 1 describes the topography and the morphology of the sea floor and relates their origin to sedimentation and geotectonic processes. Chapter 2 deals with the physical properties and the chemical composition of seawater. It is followed by a chapter on oceanographic instrumentation and the standard measuring techniques. Chapters 4 and 5 present the oceans heat and water budget and the resulting distribution of water masses and ice. The fundamentals of geo- and biochemistry are given in Chapter 6 on the chemical budget of the ocean. The theory of ocean currents, i.e., the basic hydrodynamical equations, are treated for those simplifications which are considered the base for understanding the driving and the controlling forces.

A chapter on surface and internal waves and a chapter on tidal phenomena complete the presentation of the basic material, which is then applied in Chapter 10 on a physical description of the world oceans. Bibliography (395 items).

Dorratcague, D.E., Humphrey, J.H., and Black, R.D. Determination of Flood Levels on the Pacific Northwest Coast for Federal Insurance Studies. Proceedings, 25th Annual Hydraulics Division Specialty Conference, College Station, Texas, August 10-12, 1977, 73-81.

The determination of coastal flood zones for the Flood Insurance Administration of the US Department of Housing and Urban Development required the development of a methodology for determining annual maximum water level frequency relationships. Specifically, the 10-, 50-, 100-, and 500-year flood elevations on the open coast and in estuaries were required. The northern Oregon and southern Washington Coastal areas that were studied are characterized by shallow sloping and sandy beaches below the high tide line and either sand dunes or rock cobble banks above the high tide line. In many areas houses and motels have been built on these dunes and banks. A number of these existing and proposed structures are subject to ocean flooding and wave damage. Flood levels on the open coast are determined by a combination of astronomical tide and storm surge, which comprise the stillwater level, and storm wave runup. Not only must the magnitude of these three components be computed, but a frequency of occurrence must be assigned to their combined height. References (10 items).

Doyle, B.E., and Wilson, R.E. Lateral Dynamic Balance in the Sandy Hook to Rockaway Point Transect. ESTUARINE AND COASTAL MARINE SCIENCE, 6(2):165-174, February 1978.

Currents associated with the residual nontidal flow through the Sandy Hook to Rockaway Point Transect exhibit considerable vertical and lateral structure including a two-layer estuarine flow pattern over much of the Transect and inflow to New York harbor at all depths near Rockaway Point. To determine the relative importance of different dynamic processes in maintaining this structure, the nontidal lateral momentum balance in the Transect has been examined using current meter and hydrographic data from the 1952 and 1958-1959 US Coast and Geodetic Survey field studies in New York Harbor. Results suggest that over the entire Transect the lateral pressure gradient force balances the sum of the centrifugal force associated with the oscillating tidal flow and the Coriolis force due to the nontidal flow normal to the Transect. The balance is maintained without significant contribution from turbulent shear stresses. Over much of the Transect the primary balance is between the lateral pressure gradient force and the centrifugal force. References (6 items).

Dronkers, J.J. Some Practical Aspects of Tidal Computations. (See complete entry in Section VI.)

Dvoryaninov, G.S. Theoretical Model of Mass Transport By Gravity and Tidal Waves. OCEANOLOGY, 18(6):640-647, June 1979.

Allowance is made in the model for the rotation of the earth and the turbulent character of motion. The problem reduces to the solution of 8 second-order ordinary differential equations. Turbulence has no effect on the rate of mass transport at the outer edge of the boundary layer, and is significant only inside it. Mass transport by Kelvin and Sverdrup waves and also by nonrotating long waves advancing at an angle to the coast is analyzed. References (13 items).

Dyer, K.R. Lateral Circulation Effects in Estuaries. In: Estuaries, Geophysics and the Environment, Washington, DC, NATIONAL ACADEMY OF SCIENCES, 2:22-29, 1977.

Mathematical models of estuarine circulation have been applied to a variety of problems mainly concerned with predicting the dispersal of pollutants, both during a tidal cycle and over longer periods. Most models necessarily make an assumption about the relative importances of the vertical and lateral circulation effects. References (13 items).

Dyke, P.P.G. On the Stokes' Drift Induced by Tidal Motions in a Wide Estuary. ESTUARINE AND COASTAL MARINE SCIENCE, 11(1):17-25, July 1980.

This paper presents a simple analytical model of tidal motion in a wide estuary. The essential feature of the model is its ability to include both the Coriolis acceleration and, to a limited extent, vertical stratification of density. It is shown that the Coriolis acceleration is not important when considering the depth integrated or barotropic flow, but it is important when considering baroclinic motions. Further, arguments are presented to show that the Stokes' drift is a fair representation of tidally induced residual flow, and that barotropic Stokes' drift on the kind of length scales appropriate to an estuary are dominated by friction. However, when considering depth dependent flow (the baroclinic mode), an *inviscid Stokes' drift* is present having a typical magnitude of 2 cm s^{-1}. The flow pattern for this drift in a straight sided estuary shows an equal and opposite flow along each bank, with the flow itself exhibiting a periodic structure (i.e. reversals) at well defined intervals down the estuary. The Stokes' drift along the axis of symmetry of the estuary is zero. Applications of this model to real estuaries are also discussed. References (19 items).

Edinger, J.E., and Buchak, E.M. Numerical Hydrodynamics of Estuaries. (See complete entry in Section VI.)

Ekblom, R. The Ten Per Cent Method of Predicting Tide Levels Between High and Low Water. INTERNATIONAL HYDROGRAPHIC REVIEW, 55(2):91-97, July 1978.

The paper describes a quick and simple method of obtaining intervening tide levels, given predicted high and low water and given a precomputed diagram for any one station. It is

suggested that the diagram described should be printed alongside predicted high and low waters in tide tables and/or on charts which include the appropriate tidal station. References (3 items).

Escoffier, F.F., and Walton, T.L., Jr. Inlet Stability Solutions for Tributary Inflow. Journal of the Waterway, Port, Coastal and Engineering Division, Proceedings, ASCE, 1959, WW4:341-345.

Formulas in use relating to the flow of water through tidal inlets do not take into account the joint effects of inertia and tributary inflow that play a significant role in determining the characteristics of many inlets. In a proposed analytical model these two factors are considered where the tributary inflow to the bay causes ebb flow through the inlet to exceed flood flow. References (8 items).

Falconer, R.A. Application of Numerical and Physical Models in Harbour Design. (See complete entry in Section VI.)

Falconer, R.A. Numerical Modeling of Tidal Circulation in Harbors. (See complete entry in Section VI.)

Farmer, D.M., and Smith, J.D. Tidal Interaction of Stratified Flow with a Sill in Knight Inlet. DEEP-SEA RESEARCH, 27(3/4A):239-254, 1980.

Observations of tidally driven flow of stratified water over a sill in Knight Inlet, British Columbia, have revealed a broad variety of different interactions depending upon the degree of stratification and the strength of tidal forcing. The flows are described on the basis of a Froude number dependence relating the barotropic tidal velocity to the long internal wave speed over the sill crest. For flows critical or supercritical with respect to all internal modes, an internal hydraulic jump occurs. However, typical summer conditions result in flow that is subcritical with respect to the lowest mode but supercritical with respect to higher modes; the interaction in this case results in a massive mode 2 lee wave or jump accompanied by instabilities up to 50 m high. A further, unexpected finding is the generation of nonlinear mode 1 internal wave trains upstream of the sill during strong tides. References (21 items).

Feuillet, J.-P., and Fleischer, P. Estuarine Circulation: Controlling Factor of Clay Mineral Distribution in James River Estuary, Virginia. (See complete entry in Section II.)

Finley, R.J., and Baumgardner, W., Jr. Interpretation of Surface-Water Circulation, Aransas Pass, Texas, Using Landsat Imagery. REMOTE SENSING OF ENVIRONMENT, 10(1):3-22, August 1980.

The development of plumes of turbid surface water in the vicinity of Aransas Pass, Texas, has been analyzed using Landsat imagery. The shape and extent of plumes present in the Gulf of Mexico is dependent on the wind regime and astronomical tide prior to and at the time of satellite overpass. The best developed plumes are evident when brisk northerly winds resuspend bay-bottom muds and flow through Aransas Pass is increased by wind stress. Seaward diversion of nearshore waters by the inlet jetties was also observed. A knowledge of surface-water circulation through Aransas Pass under various wind conditions is potentially valuable for monitoring suspended and surface pollutants. References (29 items).

Fischer, G. Results of a 36-Hour Storm Surge Prediction of the North Sea for 3 January 1976 on the Basis of Numerical Models. (See complete entry in Section VI.)

Fischer, H.B., ed. Transport Models for Inland and Coastal Waters; Proceedings of a Symposium on Predictive Ability of Surface Water Flow and Transport Models, held in Berkeley, California, August 18-20, 1980. (See complete entry in Section VI.)

Fischer, K. Numerical Model for Density Currents in Estuaries. (See complete entry in Section VI.)

FitzGerald, D.M., and FitzGerald, S.A. Factors Influencing Tidal Inlet Throat Geometry. (See complete entry in Section II.)

Fitzgerald, D.M., Nummedal, D., and Kana, T.W. Sand Circulation Pattern at Price Inlet, South Carolina. (See complete entry in Section II.)

Flugge, G. Horizontal Diffusion in Tidal Models and Scaling Criteria for Thermal Hydraulic Model Tests. (See complete entry in Section VI.)

Franco, A.S. On Karunaratne's Method of Checking Hourly Tidal Heights. THE INTERNATIONAL HYDROGRAPHIC REVIEW, 59(1):143-147, January 1982.

Karunaratne's Harmonic Component Fit Method (HCFM) is a very efficient and inexpensive method of checking hourly tidal heights. It has been in use in Brazil almost since its publication. Some simplifications have been introduced which have proved to be extremely useful. The method was tried with mixed tides in southern Brazil as well as the semidiurnal shallow-water tides in the Amazon estuary. This paper explains the way HCFM is used in Brazil. References (2 items).

Frisch, A.S., and Weber, B.L. A New Technique for Measuring Tidal Currents by Using a Two-Site HF Doppler Radar System. (See complete entry in Section VII.)

Gardner, G.B., Nowell, A.R.M., and Smith, J.D. Turbulent Processes in Estuaries. In: Estuarine and Wetland Processes, with Emphasis on Modeling. Edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1-34, 1980.

The survey reviews some of the ideas and results that have been published recently in the fluid dynamics literature on the mechanics of mixing in boundary layers and in free shear layers, then applies these concepts along with recent estuarine measurements to an assessment of the present understanding of estuarine dynamics with particular emphasis on those

Wolf, J. Estimation of Shearing Stresses in a Tidal Current with Application to the Irish Sea. Marine Turbulence; Proceedings of the 11th International Liege Colloquium on Ocean Hydrodynamics, edited by Jacques C.J. Nihoul. Amsterdam, Elsevier Scientific Publishing Company, 1980, 319-344.

New estimates of the bed shear stress have been made from a set of current and elevation data covering a period of a month at three stations in the Irish Sea. Harmonic analysis of these data has made it possible to obtain various harmonic components of the bottom frictional stress by solving the depth-integrated equation of motion. Some unexpected results for the relation between friction stress and bottom current have been obtained. There appears to be a phase difference between stress and current at the bed, and the ratio of stress to the velocity squared law appears to vary with frequency. In addition a 12-hr time series of vertical profiles of current was available at one station. This has been used to calculate time series of shearing stresses at each depth and obtain profiles of eddy viscosity. There is some evidence of a phase lag between the calculated stress at any depth and the current shear at that depth. References (13 items).

Wood, T. A Modification of Existing Simple Segmented Tidal Prism Models of Mixing in Estuaries. (See complete entry in Section VI.)

Yanagi, T. Vertical Residual Flow in Kasado Bay. JOURNAL OF THE OCEANOGRAPHICAL SOCIETY OF JAPAN, 35(3-4):168-172, September 1979.

Some observations were carried out to understand the structure of the vertical residual flow in Kasado Bay. The results of current measurements at three points in the lower layer indicated that a horizontal counterclockwise tidal residual circulation converges in the lower layer. The velocity of upward residual flow was estimated to be about 4.5 $\times 10^{-3}$ cm s^{-1}. The distributions of water temperature, salinity, and size in the sediment support the existence of this upward motion.

Yoshida, S., and Kashiwamura, M. Tidal Response of Two-Layered Flow at a River Mouth. (See complete entry in Section III.)

Zetler, B., Cartwright, D., and Berkman, S. Some Comparisons of Response and Harmonic Tide Predictions. INTERNATIONAL HYDROGRAPHIC REVIEW, 56(2):105-115, July 1979.

Empirical tests compared response and harmonic tide predictions for Atlantic City and Pensacola (semidiurnal and diurnal tidal regimes, respectively). Three years of hourly heights were analyzed by both methods in the frequency range of one to six cycles per day. The results were used to predict another 3-year period, the predictions were subtracted from the observations, and energy calculations were made for the frequency bands in each of the six tidal species. Once more, response methods were somewhat better, but the differences are small compared to the total (unpredictable) continuum. The study disclosed: (1) the need to include third-order nonlinear interactions of diurnal tides in response predictions for some stations, (2) the need for National Ocean Survey to examine carefully its rejection limit in analyzed amplitudes of 0.03 foot and a practice of inferring T_2 regardless of its amplitude, and (3) the need to examine an annual modulation of M_2 presumably due to some local seasonal effect. References (8 items).

Zimmerman, J.T.F. Dynamics, Diffusion and Geomorphological Significance of Tidal Residual Eddies. NATURE, 290(5807):549-555, 16 April 1981.

Many shallow tidal areas show the occurrence of ebb and flood surpluses, organized in cell-like structures or 'tidal residual eddies.' They seem to arise from a nonlinear transfer of vorticity from the oscillating tidal field to the mean field, the irregular structure of the bottom topography, or the coastline acting as a catalyst to produce the necessary vorticity gradients. The dynamical characteristics of the eddies assist our understanding of the geomorphology of the sea bed. References (45 items).

Zimmerman, J.T.F. Vorticity Transfer by Tidal Currents Over an Irregular Topography. JOURNAL OF MARINE RESEARCH, 38(4):601-630, November 1980.

Production of topographic vorticity by vortex stretching and bottom friction in circularly rotating currents in shallow tidal areas is studied as a function of topographic length scale. It is shown that vorticity is transferred from the oscillating field to the mean (residual) field and to higher harmonics (the overtides). For a given slope in the bottom topography the transfer is largest for a topographic wavelength of the order of the tidal displacement amplitude. Decreasing the bottom friction parameter increases the absolute value of residual vorticity produced either by topographic stretching of fluid columns having planetary vorticity (the Coriolis effect) or by bottom frictional torques. Residual vorticity produced by the Coriolis effect is positively correlated with the topography--circulation anticyclonic around hills--whereas bottom friction may produce either anticyclonic circulation around hills in the case of an anticlockwise rotating tidal current velocity vector, or the vector. If two fundamental frequencies in the basic tidal current are present--for instance M_2 and S_2--vorticity is also transferred to the sum and difference frequencies of which the fortnightly component (the spring to neap cycle) is discussed. Also the response of this component is shown to be rather sensitive to the forcing scale in the topography, whereas in favorable circumstances its phase may be such that maximum vorticity occurs near to neap tides rather than to spring tides. The theory gives, for values of the relevant parameters representative for a tidal shelf sea, residual vorticity of the order of 10^{-6} to 10^{-5} s^{-1}. Vorticity transfer is shown to be a strong source too for M_4 and M_6 tidal signals in current velocity records. References (20 items).

Wang, D.-P. Wind-Driven Circulation in the Chesapeake Bay, Winter 1975. JOURNAL OF PHYSICAL OCEANOGRAPHY, 9(3):564-572, May 1979.

Nontidal circulation in Chesapeake Bay was examined from 1-month current records at 50 and 200 km from the entrance. The monthly mean flow was basically a two-layered circulation; in addition, there were large wind-driven velocity fluctuations at several-day time scales. Corresponding to velocity changes, the salinity distribution had large variations, comparable to its seasonal change. Bay water responded to longitudinal (local) wind and coastal (nonlocal) Ekman flux. The response was barotropic in the lower Bay, and baroclinic (frictional) in the upper Bay. The difference in response characteristic appears to be due to the countereffects of the near-surface windstress shear and the depth-independent surface slope. A frictional model accounts for most of the observed features. Results of this study provide further evidence of large, atmospherically induced exchange between the estuary and coastal ocean. The importance of wind on upstream salt intrusions is also clearly demonstrated. References (9 items).

Wang, Y.H. Determination of Interfacial Eddy Diffusion Coefficient of Highly Stratified Estuary. (See complete entry in Section III.)

Ward, G.H., Jr. Hydrography and Circulation Processes of Gulf Estuaries. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 183-215.

Gulf estuaries (excluding the Mississippi) are lagoonal embayments, which, although possessing qualitative features common to most estuarine circulations, frequently exhibit these in extreme ranges or altered importance. These hydrographic features must be considered in developing or applying transport models (and hence water quality models) for these systems. In particular the following factors are generally the most important to bay hydrography: meterological forcing, tides, fresh-water inflow, and density currents. The bays are sensitive to meteorological forcing, especially relative to the feeble tidal effects. Among the important meteorological influences are wind waves, large-scale wind-driven gyres, and flushing due to frontal passages. Fresh-water inflows are highly transient and are important in establishing salinity gradients. Insofar as general water-quality considerations are concerned, the density current affects the large-scale circulation and transport within the bay, and is extremely important when the bay is transected by deep-draft ship channels (as are most of the Gulf estuaries). Mathematical water quality (including salinity) models usually parameterize the density-current transport by an inflated dispersion coefficient; however, this approach is poorly founded theoretically, and for bays can lead to large errors in the water quality predictions. Examples are presented to display the characteristics and significance of each of these factors, and available modeling techniques (both physical and mathematical) are appraised with respect to each. References (32 items).

Warluzel, A., and Benque, J.P. Dispersion in a Tidal Sea. Marine Turbulence; Proceedings of the 11th International Liege Colloquium on Ocean Hydrodynamics, edited by Jacques C.J. Nihoul. Amsterdam, Elsevier Scientific Publishing Company. 1980, 363-373.

The theory which is presented defines the dispersion in tidal flow by a tensor (2 × 2). Each component of this dispersion tensor is expressed in terms of turbulent diffusion and variation of the horizontal velocity field around its mean value along the depth. A mathematical model gives the minimum values for each component of the dispersion tensor when the bottom is flat, the sea infinite, without wind, and when the turbulent diffusion is known. On the other hand components of the dispersion tensor have been calculated from field measurements. References (3 items).

Wave and Tidal Energy. (See complete entry in Section VI.)

Weatherly, G.L., Blumsack, S.L., and Bird, A.A. On the Effect of Diurnal Tidal Currents in Determining the Thickness of the Turbulent Ekman Bottom Boundary Layer. JOURNAL OF PHYSICAL OCEANOGRAPHY, 10(2):297-300, February 1980.

Diurnal tidal currents at midlatitudes (25-45°) and the effect on the turbulent bottom Ekman layer was considered. Predictions of a numerical model suggested that the thickness of the layer was determined by the clockwise polarized component of the diurnal tide at such latitudes if its amplitude is comparable to the mean current. References (11 items).

West, J.R., and Broyd, T.W. Dispersion Coefficients in Estuaries. (See complete entry in Section III.)

West, J.R. and Cotton, A.P. The Measurement of Diffusion Coefficients in the Conwy Estuary. (See complete entry in Section VII.)

Whalin, R.W., Perry, F.C., and Durham, D.L. Model Verification for Tidal Constituents. (See complete entry in Section VI.)

Wilding, A., Collins, M., and Ferentinos, G. Analyses of Sea Level Fluctuations in Thermaicos Gulf and Salonica Bay, Northwestern Agean Sea. ESTUARINE AND COASTAL MARINE SCIENCE, 10(3):325-334, March 1980.

Short period (2.4 to 2.7 hr) and long period (several days) oscillations of nontidal origin have been identified in the analysis of a short series of sea level records from stations in Salonica Bay and Thermaicos Gulf. Oscillations of short period can be attributed to seichelike motions; those of long period correspond with variations in barometric pressure. The harmonic constituents are generally indicative of a standing tidal wave over the whole of the area. References (10 items).

the bottom friction. For the depth-averaged velocity, it was found that the equation of motion could be approximated by the shallow-water equation and thus could be solved easily by a numerical method. The vertical variations of the tidal current, which are functions of the depth-averaged velocity, were computed for various forms of the vertical eddy viscosity and compared to observations. The dynamics of the tidal current are discussed and explained through the variation in acceleration that results from the frictional and Coriolis forces, and in terms of the interaction between these two forces. References (22 items).

Tee, K.-T. The Structure of Three-Dimensional Tide-Induced Currents; Part II: Residual Currents. JOURNAL OF PHYSICAL OCEANOGRAPHY, 10(12):2035-2057, December 1980.

A simple method of computing the second-order, three-dimensional, tidally induced residual current is presented. The depth-averaged residual current and the mean-surface gradient from the depth-averaged equations are first computed, assuming that the bottom friction is linearly proportional to the depth-averaged residual current. The frictional coefficient is proportional to the amplitude of the first-order oscillating current and inversely proportional to the depth of the water column. Using the computed values of the mean-surface gradient, the vertical variation of the residual current for various forms of the vertical eddy viscosity can be computed numerically. An example of the computation is shown for a tidal wave that propagates perpendicularly to a straight coast and has all the variables independent of the longshore direction. The direction of the computed Lagrangian residual current disagrees with the previous study by Johns and Dyke (1972) who simplified the computation by applying the bottom boundary layer approximation and assuming that there was no residual current in the frictionless layer. The dynamics of the residual current is discussed and explained. This simple method does not include in the bottom stress the deviations resulting from the advection, surface stress, Coriolis effect, and the relationship between the friction coefficient and the vertical eddy viscosity. Detailed analyses of these deviations are presented. The simple method can be improved by including these deviations. For the example studied here, the accuracy of the solution obtained without including the deviation in the bottom stress is found to be generally within ~20-30%. References (17 items).

Tee, K.-T. Tide-Induced Residual Current--Verification of a Numerical Model. (See complete entry in Section VI.)

Townson, J.M., Davies, M.E., and Matsoukis, P. Numerical Simulations of the Bristol Channel Tide. (See complete entrv in Section VI.)

Ueshima, H., Fujiwara, T., and Hayakawa, N. Salt Transport Mechanism in Tidal Waters. (See complete entry in Section III.)

Vincent, C.E. The Interaction of Wind-Generated Sea Waves with Tidal Currents. JOURNAL OF PHYSICAL OCEANOGRAPHY, 9(4):748-755, July 1979.

The interaction between wind-generated surface waves and tidal currents can be described in terms either of the energy balance of the system or of the conservation of wave action, assuming that the tidal currents are weak. Analytical solutions for the variation in surface wave amplitude and wave number are shown for the case where the surface waves are in deep water and are propagating parallel to the direction of tidal wave propagation, using the energy balance approach. Wave analysis from two adjacent sites in the southern North Sea show that wave heights during two 16-day periods were modulated at a period of 12-13 hr and that higher waves were occurring when the waves were propagating in the same direction as the tidal current. A simplified model for the tidal regime in this area was used to compute the theoretical modulation of the wave amplitude from the energy balance equations and these were compared with the observed wave heights. Very good correspondence was found between the phases of the modulations, but the observed wave height variations exceeded those predicted by over 50 percent. The limitations of this analysis and some possible causes of this underestimation are discussed. References (20 items).

Vincent, C.L., and Corson, W.D. The Geometry of Selected U. S. Tidal Inlets. (See complete entry in Section VIII.)

Waldrop, W.R., and Farmer, R.C. A Computer Simulation of Density Currents in a Flowing Stream. (See complete entry in Section III.)

Wang, D.-P. Subtidal Sea Level Variations in the Chesapeake Bay and Relations to Atmospheric Forcing. JOURNAL OF PHYSICAL OCEANOGRAPHY, 9(2):413-421, March 1979.

Subtidal sea level variations in the Chesapeake Bay were examined over a 1-year period for evidence of wind-driven barotropic circulation. The major transport occurred at time scales of 3-5 days, whose magnitude was larger than the river runoff. It was driven by the east-west wind, as part of the coupled coastal ocean-estuary response. At shorter time scales, there was also large barotropic motion which, however, was driven by the local, north-south wind. The variance of barotropic fluctuation was larger by a factor of 4 in winter than in summer, due to the increased cyclone activities. The coupled coastal ocean-estuary response was also more pronounced in winter. In contrast, the summer season was dominated by local forcing at time scales of 3-7 days. The results suggest that the barotropic motion is an important component of the net circulation. The corresponding subtidal sea level change contributes significantly to the storm surge. Thus, the nature of barotropic response, particularly the coupled response, must be carefully examined for better understanding of the dispersion processes and storm surges in Chesapeake Bay. References (15 items).

Prediction methods used by the UK Storm Tide Warning Service at Bracknell in forecasting tidal variation are outlined with special emphasis on the recently extended function of forecasts on negative surges. The service has an operational season from late August through April. Divisions of the east coast of England for flood warning purposes are listed. The empirical equations developed and revised in testing over many years are examined; limitations and errors due to meteorological, oceanographic, and other factors are discussed. The newer negative tide surge equations give predictions of about the same accuracy as those for positive surges. Generally, the equations serve well their purpose of predicting surges.

Stout, H.P. Prediction of Oxygen Deficits Associated with Effluent Inputs to the Rivers of the Forth Catchment. (See complete entry in Section IV.)

Svendsen, H., and Thompson, R. Wind-Driven Circulation in a Fjord. JOURNAL OF PHYSICAL OCEANOGRAPHY, 8(4):703-712, July 1978.

Currents, temperature, salinity, wind, runoff, and water level were observed for a month in the Jøsen-fjord of southern Norway. Tide gages and currents show little semidiurnal tide. There is a strong diurnal signal in the upper 20 m, which a linear model shows to be caused by the wind. There is a week-long event in which the entire water mass above the sill is flushed out; this is interpreted to be caused by downwelling outside the fjord. The strong stratification near the surface of the fjord greatly modifies the diurnal response of the fjord, but any density-driven mean circulation is at least an order of magnitude smaller than the wind-driven currents. References (17 items).

Swift, M.R., Reichard, R., and Celikkol, B. Stress and Tidal Current in a Well-Mixed Estuary. Journal of the Hydraulics Division, Proceedings, ASCE, 105(HY7):785-799, July 1979.

A procedure for calculating the vertical shear stress distribution in tidal channels of well-mixed estuaries from current profile measurements is formulated. A linearized boundary layer form of the Navier-Stokes equation and an eddy viscosity representation of Reynolds shear stress are used to determine the depth and time dependence of current velocity and stress. A lower (near bottom) boundary condition on stress is employed rather than the usual no-slip condition on velocity. A verification experiment is described in which the theoretical model is used to calculate stress from current profile data taken in a tidal channel over a half tidal cycle. The predicted stress is then compared with a direct independent measurement of Reynolds shear stress. It is shown that for a one-layer estuary model best results are obtained using an eddy viscosity having a quadratic depth dependence. References (9 items).

Taylor, R.B. Dispersive Transport in River and Tidal Flows. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3336-3357.

Analytical results are presented which describe the mechanisms of longitudinal dispersive mass transport in rectangular channels of finite and infinite widths for both unidirectional (river) and oscillatory (tidal) flow regimes. Emphasis is placed upon the discussion of results and the characteristics of longitudinal dispersive mass transport revealed by the analytical treatment. Expressions presented for the dispersion coefficient were obtained from solutions to four sets of boundary value problems for the velocity and concentration variation components u' and c'. Examination of these expressions reveals that in oscillatory flow the dispersive mass transport is described by a type of resonant interaction between the period of oscillation and the time scales of vertical and lateral mixing. The analysis also shows that for oscillatory flow regimes the effect of lateral shear becomes negligible for very wide channels and the three-dimensional solution collapses to the two-dimensional case in which vertical shear and mixing effects dominate. It is shown analytically that this is not the case in unidirectional flows. For this case the lateral shear and mixing effects dominate the corresponding vertical effects and dispersive mass transport increases without bound with increasing channel widths. References (12 items).

Tee, K.-T. The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model. ESTUARINE, COASTAL AND SHELF SCIENCE, 14(1):27-28, January 1982.

In an earlier paper (Tee 1979), a simple model for computing the three-dimensional structure of the tidal current in a well-mixed water column was presented. To examine the validity of the theoretical model, 12 current meters were moored at three locations at the head of the Bay of Fundy; four meters were moored in each location at different depths. In order to investigate the significance of the small semiminor axis, and the small vertical variation of phase and inclination of the semimajor axis, the error of the analyzed harmonic constants has been examined in detail. New formulas for estimating the error for nonseparated constituents, and for the semimajor axis, semiminor axis and the phase and inclination of the semimajor axis have been derived. A discussion of when the simple formulas for limiting cases can be applied has also been included. By comparing the analyzed coefficients with Tee's (1979) simple model, it was found that by using realistic forms of the vertical eddy viscosity, the simple theoretical model reproduced the observed vertical variation of the tidal currents in the well-mixed estuary reasonably well.

Tee, K.-T. The Structure of Three-Dimensional Tide-Generating Currents; Part I: Oscillating Currents. JOURNAL OF PHYSICAL OCEANOGRAPHY, 9(5):930-944, February 1979.

A simple method for computing first-order three-dimensional tidal currents is presented. The method involves solving separately the equations for the depth-averaged velocity and the vertical velocity gradient. The interaction between these two equations is through

Schmidt, G.M. The Exchange of Water Between Prince William Sound and the Gulf of Alaska. Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science at the University of Alaska, May 1977.

Prince William Sound is a complex fjord-type estuarine system bordering the northern Gulf of Alaska. This study is an analysis of exchange between Prince William Sound and the Gulf of Alaska. Warm, high salinity deep water appears outside the Sound during summer and early autumn. Exchange between this ocean water and fjord water is a combination of deep and intermediate advection intrusions plus deep diffusive mixing. Intermediate exchange appears to be an annual phenomenon occurring throughout the summer. During this season, medium scale parcels of ocean water centered on temperature and NO maxima appear in the intermediate depth fjord water. Deep advective exchange also occurs as a regular annual event through the last summer and early autumn. Deep diffusive exchange probably occurs throughout the year, being more evident during the winter in the absence of advective intrusions. References (57 items).

Schwiderski, E.W. Global Ocean Tides, Part I: A Detailed Hydrodynamical Interpolation Model. (See complete entry in Section VI.)

Sea Grant Publications Index 1979. Edited by Betty M. Edel. Compiled by Catherine Roques. Narragansett, National Sea Grant Depository, University of Rhode Island, January 1980.

This Index provides a complete listing of all publications generated by the National Sea Grant Program in 1979. It includes technical reports, reprints, conference proceedings, newsletters, marine advisory reports, directories, pamphlets, and brochures. This publication supplements all earlier issues of the Index, which cover the period 1968-78.

Shemdin, O.H., et al. Comprehensive Monitoring of a Beach Restoration Project. (See complete entry in Section V.)

Sholkovitz, E.R. Chemical and Physical Processes Controlling the Chemical Composition of Suspended Material in the River Tay Estuary. (See complete entry in Section II.)

Smith, L.H., and Cheng, R.T. Tidal Stream Flow Solved by Galerkin Technique. (See complete entry in Section VI.)

Smith, M.R., Reichard, R., and Celikkol, B. Stress and Tidal Current in a Well-Mixed Estuary. Journal of the Hydraulics Division, Proceedings, ASCE, 105(HY7):785-799, July 1979.

A procedure for calculating the vertical shear stress distribution in tidal channels of well-mixed estuaries from current profile measurements is formulated. A linearized boundary layer form of the Navier-Stokes equation and an eddy viscosity representation of Reynolds shear stress are used to determine the depth and time dependence of current velocity and stress. A lower (near bottom) boundary condition on stress is employed rather than the usual no-slip condition on velocity. A verification experiment is described in which the theoretical model is used to calculate stress from current profile data taken in a tidal channel over a half tidal cycle. The predicted stress is then compared with a direct independent measurement of Reynolds shear stress. It is shown that for a one-layer estuary model best results are obtained using an eddy viscosity having a quadratic depth dependence. References (9 items).

Smith, T.J., and Takhar, H.S. A Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation. (See complete entry in Section VI.)

Snyder, R.M. Tidal Hydraulics in Estuarine Channels. Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY2):237-245, February 1980.

Alternating hydraulic flow (typical of estuarine areas) cannot be accurately treated using techniques developed for open channels or for the open oceans. As tidal energy approaches our coastlines, the potential energy is converted to kinetic energy resulting in forced vibrations within our estuarine systems. These "hydraulical vibrations" are periodic rather than truly harmonic but can be considered to be harmonic for a first-order approximation. By making the analogy to electrical alternating current flow with a quadratic resistance term, the equation of motion of tidal channel flow can be written. Solution of this harmonic equation in simplified form leads to expressions for channel resistance, channel capacitance, and channel inductance which combine, according to the phase angle between tidal amplitude and tidal current, to form channel impedance. These equations reduce to the familiar Darcy-Weisbach equation for steady-state open channel flow. References (8 items).

Sorensen, R.M., and Seelig, W.N. Hydraulics of Great Lakes Inlet-Harbors Systems. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1646-1665.

Reversing currents in inlets on the Great Lakes are generated primarily by long wave seiching modes of the lakes rather than by the tide. In order to investigate the nature of long wave excitation and the generating mechanism for significant inlet velocities, to establish techniques for predicting inlet-harbor system response, and to develop base data for future planning and design studies, field measurements were conducted in 1974-75 at several harbors on the Great Lakes. Data collected include continuous harbor water level measurements at all sites, inlet velocity measurements at all sites, inlet velocity measurements at the primary site (Pentwater, Michigan), and channel hydrographic surveys at the sites where more recent data were needed. Historic water-level and velocity data for some of the harbor sites were also available. References (11 items).

Stelling, G.S. Improved Stability of Dronkers' Tidal Schemes. (See complete entry in Section VI.)

Storm Tide Warning Service Extends Forecast. DOCK AND HARBOUR AUTHORITY. 61(714):4-6, May 1980.

complex or the reach is one of transition. References (16 items).

Redfield, A.C. The Tides of the Waters of New England and New York. WOODS HOLE, MASS., WOODS HOLE OCEANOGRAPHIC INSTITUTION. 1980. 108p.

Two types of information given and compared are (1) the predictions, based on observations, which are given in the tide and current tables, and (2) the results of theory. The theory may be considered valid if its results correspond with the predictions. The theory of tides has been developed in mathematical terms. In natural channels such as the bays and straits along the coast, the depth and width are variable, and it cannot be assumed that progressive waves advance over equal distances in equal times. The important assumption on which the present analysis is based is that irregularities in the cross section of the channel do not change the relations at any position of elevation, time, and phase of the progressive waves there present, but to be related to the geography only by the phase at that place. In other words, the character of the tide in any channel is determined from its observed behavior rather than any effect calculated from the dimensions of the channel. The general theory by which the tides of this coast are explained is that the tide originates in the deep water of the off-lying ocean, principally as the result of the gravitational attraction of the moon. In crossing the continental shelf the progressive wave so produced is modified by interference of a wave arising from reflection from the coast. As the tide enters the straits and embayments which are tributary to the offshore waters, it is further modified, in the case of straits, by the interference of waves entering from their opposite ends; in that of embayments, by interference between the entering wave and its reflection from the head of the embayment. In both cases the tide is modified by the attenuation which these waves undergo within the passage and in the case of straits by the relative amplitude of the waves which enter from opposite ends. The theoretical treatment allows these effects to be evaluated numerically and thus indicates how the differences in behavior of the tide in these passages are to be explained. The first two chapters consider the origin of the tide, the constituents or partial tides of which it is composed, and the properties of the progressive wave, which is the form these constituents are assumed to have. The next two chapters deal with the interference which results when two progressive waves occur simultaneously in the same channel. Chapter III considers the case in straits which leads to the development of theoretical equations generally applicable to and of use in testing the theory. Chapter IV deals with the special case of embayments in which interference occurs between the entering wave and its reflection. The following five chapters consider special conditions which may cause the predicted tide to differ in certain respects from those predicted by the theoretical equations. The final four chapters review the tides in geographically distinct regions. Appendix A contains an account of some observations and experiments and Appendix B contains conversion factors from which metric equivalents may be obtained. References (45 items).

Riepma, H.W. Observed Short-Time Temperature Variations and Tidal Current Constants in the North Sea South East of the Dogger Bank: (Comparison of two Seasons). (See complete entry in Section VIII.)

Roberts, P.J.W. Current Measurements and Mathematical Modeling in Southern Puget Sound. (See complete entry in Section VI.)

Robinson, I.S., and Perry, J.M. Tidal Power from Rectangular Estuaries: Tidal Dynamics Constraints. (See complete entry in Section VI.)

Roelfzema, A. Effect of Harbours on Salt Intrusion in Estuaries. (See complete entry in Section III.)

Ross, B.E., Anderson, M.W., and Jerkins, P. A Set of Coordinated Mathematical Models for the Coastal Zone. (See complete entry in Section VI.)

Rydelek, P.A., and Knopoff, L. Long-Period Lunar Tides at the South Pole. JOURNAL OF GEOPHYSICAL RESEARCH, 87(B5):3969-3973, May 10, 1982.

Vertical gravity data from 6.3 years of observations at the geographic South Pole have been analyzed to determine the gravimetric factor and phase angle of the long-period tides. Annual and semiannual tides are obscured by the combination of signals arising from instrumental drift and the large annual component of barometric pressure changes at Pole. Gravimetric factors for the three major long-period tides are $\delta(Mf) = 1.589 \pm 0.0017$, $\delta(Mm) = 1.1406 \pm 0.0085$, and $\delta(Mtm) = 1.1692 \pm 0.0068$. The only statistically significant phase shift is for the fortnightly component $\lambda = 0.0151 \pm 0.0032$ days, a phase lead. Our data analysis for the gravitational factor for Mf at the South Pole indicates that the calculation of the influence of the long-period ocean tides on the earth tides at the South Pole should be reconsidered. References (9 items).

Rydelek, P.A., Knopoff, L., and Zürn, W. Observation of 18.6-Year Modulation Tide at the South Pole. JOURNAL OF GEOPHYSICAL RESEARCH, 87(B7):5535-5537, July 10, 1982.

Long-period variations in the amplitudes of the diurnal and semidiurnal gravity tides at the South Pole which are attributed to the tidal effects of the 18.6-year regression of the modes of the lunar orbit have been observed. The observations are in agreement with theoretical values of the 18.6-year amplitude modulation of these tides. References (3 items).

Sagar, B.T.A., and Frey, J. Tidal Gates. (See complete entry in Section V.)

Sarkkula, J., and Virtanen, M. Modelling of Water Exchange in an Estuary. (See complete entry in Section VI.)

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. Estuarine Research: An Annotated Bibliography of Selected Literature, with Emphasis on the Hudson River Estuary, New York and New Jersey, by W.N. Embree and D.A. Wiltshire. Hudson River Basin Water and Related Land Resources Study, Technical Paper No. 5, October 1978.

Abstracts of 177 selected publications on water movement in estuaries, particularly the Hudson River estuary, are compiled for references in Hudson River studies. Subjects represented are the hydraulic, chemical, and physical characteristics of estuarine waters, estuarine modeling techniques, and methods of water-data collection and analysis. Summaries are presented in five categories: Hudson River estuary studies; hydrodynamic-model studies; water-quality-model studies; report on data-collection equipment and methods; and bibliographies, literature reviews, conference proceedings, and textbooks. An author index is included. Omitted are most works published before 1965, environmental-impact statements, theses and dissertations, policy or planning reports, regional or economic reports, ocean studies, studies based on physical models, and foreign studies.

Nihoul, J.C.J., Runfola, Y., and Roisin, B. Shear Effect Dispersion in a Shallow Tidal Sea. Marine Turbulence; Proceedings of the 11th International Liege Colloquium on Ocean Hydrodynamics, edited by Jacques C.J. Nihoul. Amsterdam, Elsevier Scientific Publishing Company, 1980, 345-361.

The hydrodynamics of shallow continental seas like the North Sea is dominated by long waves, tides, and storm surges, with current velocities of the order of 1 m/s. The currents generate strong three-dimensional turbulence and vertical mixing, resulting, in general, in a fairly homogeneous distribution of temperature, salinity, and concentrations of marine constituents over the water column. Vertical gradients of concentrations may exist in localized areas where vertical mixing is partly (and temporarily) inhibited by stratification or during short periods of time--a few hours following an offshore dumping, for instance--before vertical mixing is completed. However such cases are very limited in space and time and, in most problems, it is sufficient to study, in a first approach, the horizontal distribution of depth-averaged concentrations.

Noye, J., May, R.L., and Teubner, M.D. Three-Dimensional Numerical Model of Tides in Spencer Gulf. (See complete entry in Section VI.)

Özsoy, E. Suspended Sediment Transport Near Tidal Inlets. (See complete entry in Section II.)

Partenscky, H.W., and Barg, G. Energy Dissipation in Tidal Estuaries. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3312-3320.

In this study, the method for damped co-oscillating tides is used to evaluate damping and energy dissipation characteristics for various estuaries of different geometry and depth. Of special interest are the damping and energy dissipation characteristics of the German tidal rivers such as Elbe, Weser, and Ems in comparison with North-American tidal estuaries. References (4 items).

Posmentier, E.S., and Raymont, J.M. Variations of Longitudinal Diffusivity in the Hudson Estuary. ESTUARINE AND COASTAL MARINE SCIENCE, 8(6):555-564, June 1979.

The coefficient of longitudinal diffusion for salt has been calculated from the distribution of salinity observed in the Hudson Estuary at nine different times during 1974. The salinity distribution appears to be quasi steady-state, and the diffusion coefficient is spatially constant between the Upper Bay and Verplanck. The diffusion coefficient varied in time by a factor of three. It was not well correlated with the stratification parameter. It was slightly less dependent on the freshwater discharge in the Estuary than on the tidal amplitude, which varies by a factor of nearly two between spring and neap tides. Salinities predicted by a model are slightly less accurate if the diffusion coefficient depends on the stratification parameter, than if the diffusion coefficient is kept constant. If the diffusion coefficient is a power function of both fresh water discharge and tidal amplitude, salinity predictions are significantly improved. These results suggest that density-induced, gravitational, vertical circulation does not dominate the longitudinal diffusion of salt in the Hudson Estuary. Transverse circulation may be at least as significant a salt transport mechanism as vertical circulation. The predictive reliability of a one-dimensional, advective-diffusive model of the salinity distribution in the Hudson Estuary depends on a realistic, variable coefficient of longitudinal diffusion for salt. Furthermore, such a model cannot use the same coefficient to predict the distribution of other properties unless the combination of transport mechanisms for these other properties is the same as that for salt. References (9 items).

Priessmann, A. Use of Mathematical Models. (See complete entry in Section VI.)

Rattray, M., Jr., and Dworski, J.G. Comparison of Methods for Analysis of the Transverse and Vertical Circulation Contributions to the Longitudinal Advective Salt Flux in Estuaries. (See complete entry in Section III.)

Redfield, A.C. The Tide in Coastal Waters. JOURNAL OF MARINE RESEARCH, 36(2):255-294, May 1978.

The tide in many straits and embayments between New York and the Bay of Fundy may be described by theoretical equations based on the interference of a progressive wave entering at one end of the reach with, in the case of straits, a second wave entering at the opposite end or, in the case of embayments, a second wave arising from the reflection of this wave from a barrier at the head of the embayment. The constants which must be introduced into the equations are found by a method of nomographic analysis. Exceptions are found in a few cases in which the topography is

Mehta, A.J., Hayter, E.J. and Christensen, B.A. A Generalized Point Velocity Method for Discharge Computations in Tidal Waterways. In: Proceedings, 25th Annual Hydraulics Division Specialty Conference on Hydraulics in the Coastal Zone, New York, ASCE, 1977, 261-268.

An analytic method is presented to allow a conversion of the velocity at any point in the cross section to the corresponding discharge through the same section, given the geometry and the bed roughness of the cross section and the water surface elevation in a nonstratified tidal entrance or waterway. For a given section, the bed roughness is essentially derived from a single set of cross-sectional velocity measurements. Application of the method is discussed in terms of data obtained in the vicinity of Matanzas Inlet, on the Atlantic coast of Florida. References (3 items).

Merriman, A.G. Admiralty Method of Tidal Prediction (Form NP 159): Refinements and Increase in Accuracy. THE INTERNATIONAL HYDROGRAPHIC REVIEW, 58(1):135-141, January 1981.

This paper is intended to supplement the paper "The Admiralty Method of Tidal Prediction, NP 159" by N.C.Glen, published in the INTERNATIONAL HYDROGRAPHIC REVIEW, 54(1), January 1977, and should be read in conjunction with that paper. (See CTH Report No. 2, Suppl No. 8, Section I, p. 19.) The Admiralty Form NP 159 is a simplified graphical method of obtaining a predicted tidal curve which gives a good approximation to that produced by a full prediction using far more data. Although at first sight it may appear rather tedious, no other method of comparable accuracy approaches its simplicity; thus, although any gain in accuracy is welcomed, any such gain must be weighed against simplicity of application if it is not to destroy the essential character of the method. This criterion has been carefully taken into account when designing these improvements. The first part of the paper concerns the simple application of an additional five constituents, while the second part shows how a programmable calculator can increase not only the ease of operation but also the accuracy of prediction by removing some approximations which have to be made in order to keep the drawing task within reasonable proportions. References (6 items).

Mittelstaedt, E., et al. Tidal Currents off Mauritania at 21°40' N. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, (6):223-235, January 1981.

Current meter measurements obtained during the coastal upwelling experiment JOINT-I (Feb. to Apr. 1974) are used to describe some aspects of the semidiurnal tidal currents on the shelf and across the continental slope off Mauritania. On the shelf the semidiurnal tides represent the dominant short-period fluctuations. Semidiurnal current speeds range between 1 and 10 $cm\ s^{-1}$. The mean speeds of about 5 $cm\ s^{-1}$ are 15% to 25% of the residual current speeds. The main contribution to the semidiurnal currents comes from the M_2 tide. The mean amplitude of the currents at the period of the S_2 tide is about half as large as the amplitude due to the M_2. The signal of tidal currents at the period of 1200 hours (S_2) is probably biased by the influence of weak semidiurnal wind variations. At the diurnal frequency band the daily wind fluctuations of the land-sea-breeze interferes with the tidal currents. When averaged over time, the semidiurnal tides inshore appear barotropic. Over the continental slope baroclinic tides contribute significantly to the tidal currents and enhance the tidal energy there. The interactions of barotropic and baroclinic tides also contribute to the observed marked phase differences of the semidiurnal currents across the continental slope. Whereas the semidiurnal currents rotate counterclockwise on the shelf they rotate clockwise 50 km offshore the shelf break. References (15 items).

Muir Wood, A.M., and Fleming, C.A. Coastal Hydraulics, 2d ed. John Wiley & Sons, New York, 1981. 280p.

In the first edition of this book (1969), the principles of hydraulics as they affect the maritime engineer were analyzed, and their application to the practical problems encountered were discussed. This new edition is more ambitious in attempting to combine a reasonable coverage of the basic physics with an adequate handbook for tackling simpler problems of coastal hydraulics and a book of reference for the more complex ones. There are chapters on basic hydraulics, tides and currents, waves, coastal sediment transport, coast and bed morphology, planning of coast protection, waves and structures, and acquisition of data. References (612 items).

Mungall, J.C.H., and Matthews, J.B. The M_2 Tide of the Irish Sea: Hourly Configurations of the Sea Surface and of the Depth-Mean Currents. ESTUARINE AND COASTAL MARINE SCIENCES, 6(1):54-74, January 1978.

The paper is concerned with a description of the M_2 tide of the Irish Sea. After a review of previous work on the area an overall view of the Irish Sea tides is presented by treating the sea as a one-dimensional channel closed at its northern end. The curves so obtained for the amplitudes and phases of the height and current distributions, along with hourly profiles of the sea surface, serve as a convenient graphical summary of the main features of the tide. The time-dependent two-dimensional behavior of the Irish Sea is described with the aid of hourly perspective views of the sea surface and hourly charts of depth-mean current vectors superimposed on lines of equal sea surface heights, a method of display which markedly supplements the conventional corange and cotidal charts. The data used for generating the displays were obtained by analyzing the output of a two-dimensional barotropic numerical tidal model. References (18 items).

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients; Proceedings of an International Symposium on the Effects of Nutrient Enrichment in Estuaries, Williamsburg, Virginia, 29-31 May 1979. (See complete entry in Section IV.)

Liu, S.-K., and Leendertse, J.J. A Three-Dimensional Model for Estuaries and Coastal Seas: Volume VI, Bristol Bay Simulations. (See complete entry in Section VI.)

Liu, S.-K., and Leendertse, J.J. Multidimensional Numerical Modeling of Estuaries and Coastal Seas. (See complete entry in Section VI.)

Loder, J.W. Topographic Rectification of Tidal Currents on the Sides of Georges Bank. JOURNAL OF PHYSICAL OCEANOGRAPHY, 10(9):1399-1416, September 1980.

The rectification of M_2 tidal currents on the sloping sides of Georges Bank is predicted to make an important year-round contribution to its observed mean clockwise circulation. A rectification mechanism involving continuity and Coriolis effects, but regulated by bottom friction (Huthnance, 1973), is operative. Huthnance's (1973) depth-averaged theory for the along-isobath mean Eulerian current associated with this mechanism and with a second, purely frictional, mechanism is extended to include mean current-tidal current interaction, spatially varying bottom friction and rotary tidal currents. The ratio of cross-isobath tidal excursion L_e to topographic length L is found to be an important nondimensional parameter in determining the degree of nonlinearity of the Coriolis mechanism. A significant Stokes velocity is associated with both rectification processes, so that, for the Coriolis mechanism, the mean Lagrangian current is only about two-thirds of the mean Eulerian current. On the sides of Georges Bank, L_e and L are of the same order, and the rectification is sufficiently nonlinear that interaction of the mean current with the tidal current is important. The mean Eulerian and Lagrangian currents, and the cross-isobath mean sea surface slopes, are predicted for half-sinusoid representations of bottom topography on the northwestern, northern, and open ocean sides of the Bank. The mean flow is closewise and concentrated over the edge of the Bank, but smeared out onto the top of the Bank by the mean current-tidal current interaction. The predicted current speeds, which are greatest on the northwestern and northern sides, are of the same order as those observed. References (14 items).

Luynenburg, R.W.E., and van Gent, W.G. Extrapolation of Short-Based Tide Gauge Data for Offshore Reduction. INTERNATIONAL HYDROGRAPHIC REVIEW, 58(2):89-100, July 1981.

This paper describes a method of extrapolating shore-based tide gauge data with the help of the Reduction Chart to produce an offshore tidal curve. An accuracy study is then performed, in which extrapolated tide curves are compared with actually observed offshore tide curves.

Mantz, P.A., and Wakeling, H.L. Forecasting Flood Levels for Joint Events of Rainfall and Tidal Surge Flooding Using Extreme Value Statistics. INSTITUTION OF ENGINEERS, PROCEEDINGS, 67(Pt2):31-50, March 1979.

As part of a flood control study for the Yare Basin in Norfolk, it was necessary to forecast flood levels caused by combinations of rainfall and North Sea tidal surges in order to obtain design heights for safe riverbank crest levels. Two methods were used. The first uses long-term annual maximum data and extreme value statistics to predict joint events of rainfall discharge and North Sea tidal surge at each end of the tidal catchment. A range of predicted joint events for a particular return period is applied to a finite difference mathematical model to find maximum water levels at the return period. Safe bank heights for 25- and 100-year return periods are thus designed. These heights are checked by the second method, which uses medium term annual maximum data and extreme value statistics for eight stations within the study area. References (16 items).

Mariette, V., et al. Tidal Currents in the Mer d'Iroise. OCEANOLOGICA ACTA, 5(2):149-159, April 1982.

Tide propagation is the principal dynamic process in the physical oceanography of the Mer d'Iroise. The very accurate and detailed knowledge of currents on which any study in this region must be based has not up to now been available in published form. A mathematical model, using tidal observations at various British and French ports, and at open sea points, permits the calculation of depth-integrated tidal currents at intervals of every nautical mile (1,853 m) and every three minutes in time in an area situated between latitudes 47°50' N and 48°30' N and longitudes 04°10' W and 05°40' W. Using a two-dimensional spline method, the values of 25 harmonic constants are interpolated for 8 points on the open boundary, and the tidal elevation is computed therefrom. Further interpolation gives the tidal elevation at every grid point, on the open boundary at all time-steps. These data are used as input to the numerical model which calculates tidal elevations and tidal currents over the whole area. The accuracy of the model is shown to be closely dependent on the boundary conditions. The results are generally satisfactory despite the fact that comparison between the measured and calculated currents presents certain difficulties. This is because the former are measured at a fixed depth, and are affected by the prevailing meteorological conditions; further inaccuracies arise from the type of current meter and the mooring technology used. Calculated currents, on the other hand, are based solely upon the tide and are vertically integrated from surface to bottom. The model shows that Eulerian tidal residuals vary very greatly from point to point throughout the area. This study is an essential step in the understanding of the formation and evolution of the thermal front in the Mer d'Iroise. References (12 items).

Mason, C. Functional Design of Tidal Entrance Structures for Effective Navigation and Channel Stability. (See complete entry in Section V.)

McDowell, D.M. Modelling Methods for Unsteady Flows. (See complete entry in Section VI.)

The method of characteristics is well suited to the simulation of one-dimensional, unsteady, open-channel flow. When a numerical scheme based upon specified time intervals is employed, one can solve the characteristics equations to second-order accuracy by the trapezoidal rule using iteration, or by applying an extrapolation procedure to two sets of linear computations using two different sizes of time interval. Numerical experiments showed virtually the same results for the two techniques. The second technique, however, is preferred for it generally consumes less computer time, and offers the option of selecting first- or second-order results. In attempting to extend the method of characteristics to two-dimensional flow in a wide river, estuary, or embayment, one finds a number of dissimilarities as well as similarities between the two cases. Many favorable features of the method of characteristics for one-dimensional flow are lost in the two-dimensional case, thus complicating the flow computation. Again, if the specified-time-interval scheme is used, second-order results may be obtained by the trapezoidal rule with iteration, or by the extrapolation procedure applied to two linear systems. However, the iteration technique in the two-dimensional flow is extremely cumbersome and solution, despite many favorable results, is not always successful. The latter offers an advantage of requiring no iteration, but it requires more memory. A number of computer programs written based on the aforementioned numerical techniques are believed by the writer to afford practical means for correctly simulating unsteady flows in various types of waterways and water bodies. References (12 items).

Leatherman, S.P., ed. Barrier Islands: From the Gulf of St. Lawrence to the Gulf of Mexico. New York, Academic Press, 1979. 325p.

The texts of 12 papers--10 presented at the Coastal Research Symposium held on 9 March 1978 in Boston, Massachusetts, organized for the Geological Society of America, Northeast Section, and the Society of Economic Paleontologists and Mineralogists, Eastern Section--focusing on barrier island dynamics are presented. A subject index is included. Contents: Barrier Island Morphology as a Function of Tidal and Wave Regime by Miles O. Hayes. Barrier Islands in the Southern Gulf of St. Lawrence, Canada, by S. B. McCann. Landward Sediment Transfers in a Transgressive Barrier Island System, Canada, by John W. Armon. Aeolian Dynamics of a Barrier Island System by Peter S. Rosen. A Geobotanical Approach to Classification of Barrier Beach Systems by Paul J. Godfrey, Stephen P. Leatherman, and Robert Zaremba. Washover and Tidal Sedimentation Rates as Environmental Factors in Development of a Transgressive Barrier Shoreline by John J. Fisher and Elizabeth J. Simpson. Processes and Morphologic Evolution of an Estuarine and Coastal Barrier System by John C. Kraft and others. Nexus: New Model of Barrier Island Development by Susan D. Halsey. Quaternary Evolution of Core Banks, North Carolina: Cape Lookout to New Drum Inlet by Thomas F. Moslow and S. Duncan Heron, Jr. Geomorphology, Washover History, and Inlet Zonation: Cape Lookout, North Carolina, to Bird Island, North Carolina, by William J. Cleary and Paul E. Hosier. Barrier Island Development during the Holocene Recession, Southeastern United States, by George F. Oertel. Barrier Island Evolution and History of Migration, North Central Gulf Coast, by Ervin G. Otvos, Jr. References (394 items).

LeBlond, P.H. On Tidal Propagation in Shallow Rivers. JOURNAL OF GEOPHYSICAL RESEARCH, 83(C9):4717-4721, September 20, 1978.

A reexamination of the momentum balance in shallow rivers, with scaling appropriate to the St. Lawrence and the Fraser, shows that frictional forces exceed accelerations over most of the tidal cycle. Consequently, tidal propagation in shallow rivers is more properly envisaged as a diffusion than as a wave propagation phenomenon. The long time lags associated with low waters, unexplainable in terms of a simple wave propagation model, are easily accounted for by an equally simple diffusive model. References (10 items).

Leendertse, J.J., and Lui, S.K. Three-Dimensional Flow Simulation in Estuaries. (See complete entry in Section VI.)

LeProvost, C., Rougier, G., and Poncet, A. Numerical Modeling of the Harmonic Constituents of the Tides, with Application to the English Channel. (See complete entry in Section VI.)

Levesque, L., Murty, T.S., and El-Sabh, M.I. Numerical Modeling of Tidal Propogation in the St. Lawrence Estuary. (See complete entry in Section VI.)

Lewis, R.E. Transverse Velocity and Salinity Variations in the Tees Estuary. ESTUARINE AND COASTAL MARINE SCIENCE, 8(4):317-326, April 1979.

Transverse variations in velocity and salinity were observed at four sections across the Tees Estuary. At each section, measurements were made simultaneously at two or three cross-stream positions over a full tidal period. The selected sections lay within two straight portions of the estuary, at a sharp bend and close to the end of a tide-training wall. Analysis of the velocity data suggested that lateral changes in the vertical gravitational circulation contributed to the net transverse circulation. The depth mean salt fluxes per unit width associated with transverse deviations from the cross-sectional means of the steady and tidal flows showed appreciable variation across the estuary, particularly where there were marked changes in the topography. Cross-stream changes in the salt flux arising from the vertical gravitational circulation were similar at each of the sections considered despite the appreciable topographic variations. Since all three fluxes are included in the longitudinal dispersion coefficient in a laterally averaged estuary model, such a coefficient will be dependent on both the topography and the freshwater flow. References (13 items).

In the present paper, we try to understand tidal phenomena in the Bays of Ariake and Yatsushiro systematically based on analysis of observed data and numerical experiment. Tide range, tidal current, tidal residual current, and inclination of mean sea level in these bays are discussed. These are modified largely from the feature of astronomical tides by meteorelogical effects in addition to nonlinear processes due to large tide range and complicated topography. References (11 items).

Jenkins, J.D., and Johnson, H.M. Flood Profiles in Combined Tidal-Freshwater Zones, Journal of the Hydraulics Division, Proceedings, ASCE, 104(HY6):912-922, June 1978.

This paper explains a solution used for a flood study in Florida on Peace River from Punta Gorda to Arcadia. Flood levels at the river mouth are caused by hurricane tidal surge. There is no tidal influence in the upper reach and flooding here is caused only by freshwater runoff. The text describes how the 100-year flood profile was calculated in the river reach affected by both tidal and freshwater runoff flooding.

Johns, B. The Modeling of Tidal Flow in the Channel Using a Turbulence Energy Closure Scheme. (See complete entry in Section VI.)

Kabbaj, A., and Le Provost, C. Nonlinear Tidal Waves in Channels: A Perturbation Method Adapted to the Importance of Quadratic Bottom Friction. TELLUS, 32(2):143-163, April 1980.

Bottom friction plays an important role in propagation and damping of long waves in shallow water. A perturbation method, well adapted to the importance of this bottom stress, is presented and applied for channels with constant mean depth and mean cross-section area. The main idea results from a development of quadratic bottom friction in a Fourier series up to the third order of approximation. A quasi-linearization of the damping effect of bottom stress is deduced from this expansion, which allows one to introduce the second-order damping effects of friction into the first-order system defining the fundamental component of the spectrum, and the main part of the third-order damping terms into the computation of the second-order harmonic components.

Keiller, D.C., and Ruxton, T.D. Waves Used for Inter-Tidal Design and Construction. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, I:23-42.

For the design of the surface protection for the reservoir embankments proposed in the recent feasibility study for water storage in the Wash, the authors have attempted to estimate the frequency of occurrence and extent of storm damage. To this end they have measured wave and wind and tide conditions at the site for 3-years to derive empirical relationships between water depth, wave height, and wind speed, direction, and fetch. To assess the frequency of occurrence of various wave heights on the inter-tidal foreshore the authors consider the duration and direction of extreme wind speeds and the probable incidence of these winds with high water. They have been able to estimate wave heights with a given frequency of occurrence at foreshore levels ranging from mean high water springs to mean low water springs in an area with a spring tide tange of 6.4 m. The frequency of damage and probability of failure of a riprap protection surface is estimated. References (9 items).

Kjeldsen, S.P. Algorithm for Vertical Diffusion. (See complete entry in Section VI.)

Kjerfve, B., and Proehl, J.A. Velocity Variability in a Cross-Section of a Well-Mixed Estuary. JOURNAL OF MARINE RESEARCH, 37(3): 409-418, August 1979.

North Inlet, South Carolina, is a well-mixed, tidally driven, high-salinity, shallow type 1A estuary consisting of winding creeks that intersect a 30 km^2 *Spartina alterniflora* salt marsh. An intensive spring tide field sampling in a 320-m-wide cross section during three consecutive tidal cycles in November 1977 resulted in detailed information on the cross-sectional net and root-mean-square (r.m.s.) velocity distributions. Although the estuary is well-mixed, both net and r.m.s. velocities vary significantly across the estuary, the deep channel typically experiencing net ebb flow and the secondary channel sometimes exhibiting net flood flow. Two high velocity cores reoccur in the same cross-sectional location each tidal cycle. Large variations in the net cross-section discharge occurred from cycle to cycle, apparently related to diurnal tide inequality. The results indicate that if material flux estimates are to be made in this type of estuary, the velocity is likely to be the parameter which requires the most danse sampling. References (18 items).

Klein, G.D., and Ryer, T.A. Tidal Circulation Patterns in Precambrian, Paleozoic, and Cretaceous Epeiric and Mioclinal Shelf Seas. (See complete entry in Section II.)

Kluth, D.J., and Ackers, P. A Mathematical Model of the Closure Problem and Permanent Operation for Tidal Power Studies. (See complete entry in Section VI.)

Knight, D.W., and Ridgeway, M.A. An Experimental Investigation of Tidal Phenomena in a Rectangular Estuary. (See complete entry in Section VI.)

Krause, G. Grundlagen zur Trendermittlung des Salzgehalts in Tide-Aestuarien (Fundamentals of Trend Analysis of Salinity in a Tidal Estuary). (See complete entry in Section III.)

Krause, G. Physical Processes in Tidal Estuaries in Relation to the Monitoring of Water Quality. (See complete entry in Section III.)

Lai, C. Some Computational Aspects of One- and Two-Dimensional Unsteady Flow Simulation by the Method of Characteristics. In: Proceedings, International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle-Upon-Tyne, England, April 12-15, 1976, D1-1-D1-12.

Ianniello, J.P. Comments on Tidally Induced Residual Currents in Fstuaries: Dynamics and Near-Bottom Flow Characteristics. JOURNAL OF PHYSICAL OCEANOGRAPHY, 11(1):126-134, January 1981.

The tidally induced Eulerian and Lagrangian residual currents in narrow tidal channels are interpreted in terms of the factors controlling their structure: the depth-integrated value (which is always seaward), the second-order velocity gradients at the bed and the surface, and the vertical structure of the driving terms in the time-averaged second-order momentum equations. The reasons for the relative complexity of the flow field in constricted channels are explained from this viewpoint. The conditions conducive to shoaling in the channel or to convergences in the near-bottom Lagrangian flow field are examined. It is shown that breadth and depth constrictions of 25% or greater lead to strong bottom-flow convergences. The surface boundary condition used in earlier studies is shown to be incorrect. This has some effect, generally slight, on previous solutions, and is shown to be most important in the upper part of the water column for the short-channel, constant-breadth-and-depth results. References (13 items).

Ianniello, J.P. Tidally Induced Residual Currents in Estuaries of Constant Breadth and Depth. JOURNAL OF MARINE RESEARCH, 35(4): 755-785, November 1977.

Two-dimensional analytical solutions of Eulerian and Lagrangian residual currents induced in narrow rectangular tidal channels are derived in terms of depth and longitudinal distance. These are due to nonlinear interactions of first-order tides. Turbulence is represented by several eddy viscosity profiles bracketing range of likely variation. Realistic profiles are selected matching observed tidal velocities and values of tidal dissipation. Induced currents have magnitudes proportional to tidal amplitude, inversely proportional to depth, and proportional to tidal current. Perturbation analysis (valid for weakly nonlinear systems) is made retaining full depth dependence of tidal driving terms. Contrary to previous analyses, study shows that Eulerian residual currents are seaward at all depths and reinforce any two-layer density currents in surface and bottom waters. Solutions are not very sensitive to details of eddy viscosity models. In addition to steady currents generated by each tidal constituent, slowly varying residual currents are also generated at different frequencies of various constituents. For typical amplitudes of M2, N2, and S2 constituents these low frequency currents (with periods of 14.77 and 27.55 days) can nearly double or cancel steady currents for a few days each month. References (26 items).

Ianniello, J.P. Tidally Induced Residual Currents in Estuaries of Variable Breadth and Depth. JOURNAL OF PHYSICAL OCEANOGRAPHY, 9(5):962-974, February 1979.

Analytic solutions are derived for the longitudinal and cross-channel Eulerian and Lagrangian residual currents induced in narrow tidal channels of variable breadth and depth, but rectangular cross section, by the nonlinear interactions of the first-order tides. The solutions are shown to be valid as long as the system is weakly nonlinear such that $g\eta_0\sigma^{-2}\Delta\chi^{-2} \ll 1$, and as long as breadth variations are sufficiently gradual that $fb_0\sigma^{-1}\Delta\chi^{-1} \ll 1$; η_0 is a typical tidal amplitude, g is the acceleration of gravity, σ the tidal frequency, $\Delta\chi$ the length scale over which the breadth changes, f the Coriolis parameter, and b_0 the channel width. Results are given for channels with exponentially decreasing breadth and depth profiles and for a channel with a constriction in the breadth profile. These results indicate that significant differences from the residual currents in constant breadth and depth channels occur for all three types but especially for the constricted channel. For this channel a strong two-layer structure with a divergence in the surface water and a convergence in the bottom water, centered at the constriction, is generated for both the Eulerian and Lagrangian currents. This two-layer reinforces any two-layer density-induced circulation seaward of the constriction and opposes it landward of the constriction. The existence of a two-layer flow has important implications for the estuarine circulation; furthermore, since such a two-layer flow will not appear in depth-averaged models of the residual currents induced in narrow tidal channels, it may confound attempts to verify such models from measurements. References (18 items).

Ianniello, J.P. Tidally-Induced Residual Currents in Long Island and Block Island Sounds. ESTUARINE, COASTAL AND SHELF SCIENCE, 12(2): 177-191, February 1981.

The tidally induced residual currents in the Long Island Sound-Block Island Sound (LIS-BIS) tidal channel are investigated using a previously developed analytic model. Known first-order tidal properties of LIS-BIS are matched using three different models, chosen to isolate the effects of the factors potentially controlling the second-order currents, either breadth, depth, or eddy viscosity variations. The residual currents driven by these first-order models agree to within roughly a factor of two, indicating that the model is not overly sensitive to these parameters. Tidally induced currents on the order of observed currents in eastern LIS and BIS are predicted. The outstanding structural features of the predicted residual currents is a region of strong surface flow divergence and bottom flow convergence centered at a sharp constriction in the channel. Eulerian and Lagrangian observations in eastern LIS and BIS are reviewed; indirect support for the theoretical results is found. References (22 items).

Imberger, J. Dynamics of a Longitudinally Stratified Estuary. (See complete entry in Section III.)

Isozaki, I. and Kitahara, E. Tides in the Bays of Ariake and Yatsushiro. THE OCEANOGRAPHICAL MAGAZINE, 28(1-2):1-32, March 1977.

Application to the Bristol Channel indicates that in the upper reaches the peak flood flow would be expected to exceed the peak ebb flow whereas in the lower reaches the converse applies; this agrees with the observed pa: ng in the direction of bedload transport near the middle of the Bristol Channel. References (9 items).

Heath, R.A. Resonant Over-Tide Across and Along Tasman Bay, New Zealand. ESTUARINE AND COASTAL MARINE SCIENCE, 8(6):583-595, June 1979.

East-west current oscillations in Tasman Bay with a quarter (6.2 h), sixth (4.1 h) and eighth (3 h) diurnal periodicity are shown to be generated by nonlinear field acceleration of the semidiurnal tidal water motion near D'Urville Island resulting from rapid change of the tidal amplitude with distance. These over-tides force oscillations directed across (quarter- and eighth-diurnal) and along (sixth-diurnal) Tasman Bay in which respective directions the quarter wavelength oscillation wave resonant periods are near the quarter- and sixth-diurnal period. References (16 items).

Heath, R.A. Tidal Energy Loss in Coastal Embayments. ESTUARINE, COASTAL AND SHELF SCIENCE, 12(3):279-290, March 1981.

The tidal energy balance for an embayment over the spring neap cycle is used to obtain a relationship between the phase of the M_2 and S_2 tidal flow at the entrance using solely tidal elevation harmonic constants as inputs. For possible values of the phase of the flow, the calculated frictional drag coefficient (k), or comparison wit observation of the variation of the phase of the flow through the spring neap cycle, may be used to allow the frictional energy dissipation to be estimated. Application to the Bristol Channel for values of k which are consistent with the generally accepted range of values used in two-dimensional numerical models gives estimates of the phase of the flow within the range of those observed and of the tidal energy dissipation consistent with previous estimates. The method should allow estimates of the energy dissipation per unit mass to be made in embayments where tidal elevation harmonic constants alone are available and thus provide an insight into the potential mixing. References (11 items).

Heath, R.A. Transmission of Tidal Energy over a Plateau. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 32(6):289-296, November 1979.

Variations in the response to an incident long wave on a step function plateau are considered as a function of the angle of incidence. For large angles of incidence there is a substantial change in the modulus of the amplitude ratio of the transmitted to incidence wave. The amplitude of the wave on top of the plateau varies strongly with the angle of incidence. Zero transmission can occur only if there is a net increase in depth across the plateau in the direction of the incident wave--the critical angle of incidence being independent of frequency. If the modulus of the angle of incidence is greater than the critical angle, wave energy is trapped along the trailing escarpment of the plateau. References (6 items).

Ho, F.P. Hurricane Tide Frequencies on the Atlantic Coast. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, I:886-905.

The tide frequency analysis technique developed by NOAA has been extended along the Atlantic coast. The simulation method has the advantages of giving results that are consistent from one stretch of coast to another, and for giving a result where there is little local data available. Tide frequencies estimated in this way form the technical basis for flood hazard boundary maps prepared for the Flood Insurance Program for communities subject to inundation from the sea. References (18 items).

Hodgins, D.O. A Time Dependent Two-Layer Model of Fjord Circulation and Its Application to Alberni Inlet, British Columbia. (See complete entry in Section VI.)

Holloway, P.E. Longitudinal Mixing in the Upper Reaches of the Bay of Fundy. (See complete entry in Section III.)

Hunter, J.R. On the Interaction of M_2 and M_{2n} Tidal Velocities in Relation to Quadratic and Higher Power Laws. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 32(4):146-153, 1979.

The time-averaged value of a term of type $u|u|^m$, caused by the interaction of a strong M_2 velocity and a weak M_2 velocity ($m, n \geq 0$) is derived for the two-dimensional case. The results, which are relevant to the evaluation of bottom shear stresses and sediment transport rates, indicate that the time average is dominated by contributions from the mean velocity ($n = 0$) and the M_4 constituent ($n = 2$). For a quadratic friction law the mean velocity is about three times as effective as the M_4 constituent in generating a time-averaged bottom stress. However, for higher values of m (as in the case of sediment transport problems) the contribution due to the M_4 constituent becomes progressively more important. References (4 items).

Huyer, A., and Smith, R.L. Physical Characteristics of Pacific Northwestern Coastal Waters. Reprinted from The Marine Plant Biomass of the Pacific Northwest Coast, 37-55, 1978.

The coastal waters of the Pacific Northwest have been studied extensively in the last two decades so that much is known about their physical characteristics, especially the circulation and stratification. The physical characteristics determine to a large extent the natural productivity of the ecosystem, and may determine whether or not it can be enhanced. This chapter describes the main physical characteristics (the circulation, stratification, tides, and waves) and the ways these might be limiting. It also outlines the kinds of information still needed to clarify the problems associated with increasing the marine plant biomass of the Pacific Northwest. (Copyright (c) by the Pacific Northwest Regional Commission). References (58 items).

estuaries with relatively large tidal ranges, where tidal averages are less useful. References (56 items).

Gardner, L.R. *Geomorphic and Hydraulic Evolution of Tidal Creeks on a Subsiding Beach Ridge Plain, North Inlet, S.C.* (See complete entry in Section II.)

Garrett, C., and Toulany, B. A Variable-Depth Green's Function for Shelf Edge Tides. (See complete entry in Section VI.)

George, K.J. and Bates, D.J. The 60 Year Sea Level at Barnstaple as Estimated Using the Convolution Method. (See complete entry in Section VI.)

Gill, S.K. and Porter, D.L. Theoretical Offshore Tide Range Derived from a Simple Defant Tidal Model Compared With Observed Offshore Tides. (See complete entry in Section VI.)

Göhren, H. Currents in Tidal Flats During Storm Surges. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, I:959-970.

This paper discusses the investigations carried out on a tidal flat, the "Neuwerker Watt," at the south side of the Elbe Estuary. Results about currents in the tidal flat area during strong winds and storm surges are presented. It discusses current measurements, velocities, and direction and equipment used, and gives typical examples of the measurements. Flume tests and simple mathematical models have been used in presenting the data. References (5 items).

Gopalakrishnan, T.C. and Machemehl, J.L. Numerical Flow Model for an Atlantic Coast Barrier Island Tidal Inlet. (See complete entry in Section VI.)

Gordon, R.B., and Spaulding, M.L. A Nested Numerical Tidal Model of the Southern New England Bight. (See complete entry in Section VI.)

Gordon, R.B., and Spaulding, M.L. A Three Dimensional Numerical Model of Estuarine Circulation. (See complete entry in Section VI.)

Gotlib, V.Y., and Kagan, B.A. Parameterizing Shelf Effects in Modeling the Ocean Tides (in English). (See complete entry in Section VI.)

Grubert, J.P. Estuarine Front Formation and Propagation. (See complete entry in Section III.)

Grubert, J.P. Experiments on Arrested Saline Wedge. (See complete entry in Section III.)

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. NBS Special Publication 583, Washington, National Bureau of Standards, October 1980.

Current and recently concluded research projects in hydraulics and hydrodynamics for the years 1977-1978 are summarized. Projects from more than 200 university, industrial, state, and Federal Government laboratories in the United States and Canada are reported.

Hamilton, G.D., Soileau, C.W., and Stroud, A.D. Numerical Modeling Study of Lake Pontchartrain. (See complete entry in Section VI.)

Hamilton, J. *Finite Difference Storm Surge* Prediction. (See complete entry in Section VI.)

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. New York, Plenum Press, 1980, 635p.

The book contains the proceedings of the Workshop on Estuarine and Wetland Processes and Water Quality Modeling, held in New Orleans, Louisiana, June 18-20, 1979, and sponsored by the US Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Some 25 papers offer an interdisciplinary review of important ecological processes and the modeling of circulation and sediment transport in estuaries. Physical and water quality assessment of intertidal salt marsh interaction with the estuary is covered in a seminal review of 20-years of speculation and research. Turbulence in estuaries, numerical hydrodynamics, modeling sediment transport in shallow waters, sediment and nutrient cycling in wetlands and between wetlands and estuaries, and impact assessment of estuarine modifications are among the other areas treated. References (1614 items).

Harleman, D.R.F. Hydrodynamics of Tidal Motion. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 7, 1973.

The process of creating and applying a one-dimensional mathematical model for the hydrodynamics of tidal motion in an estuary is described. The process and application entails: 1) establishing initial decisions in reducing the estuary geometry to one-dimensional parameters; 2) establishing general principles of schematization; 3) establishing the datum; 4) schematization of a trapezoidal cross section without storage, as a specific case; 5) schematization including storage and conveyance areas, as a specific case; 6) verification of the model; and 7) defining boundary, initial, and quasi-steady state conditions. References (5 items).

Hauck, L.M. and Ward, G.H. Hydrodynamic-Mass Transfer Model of Deltaic Systems. (See complete entry in Section VI.)

Hayter, E.J. Verification of the Hydrodynamic Regime of a Tidal Waterway Network. (See complete entry in Section VI.)

Heath, R.A. Phase Relations Between the Over- and Fundamental-Tides. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 33(5):177-191, December 1980.

Simple analytical solutions to the momentum and continuity equations have been used to obtain phase relationships between the M_4 and M_2 tides for both frictionless solutions, and when there is an assumed local balance between production and dissipation of the M_4 tide. These solutions allow the observed phase relationships for the tidal elevations to be used to indicate the probable phase relationship between the M_4 and M_2 tidal flows and hence the direction of maximum tidal flow.

SECTION II. SEDIMENTATION

Sources, identification, transportation, deposition, flocculation, and physical and chemical properties of sediment found in tidal waterways. The upland river is excluded unless specifically concerned as a source and agent of transport of tidal sediment.

Anderson, F.E. The Variation in Suspended Sediment and Water Properties in the Flood-Water Front Traversing the Tidal Flat. ESTUARIES, 3(1):28-37, March 1980.

The initial flooding waters from 24 consecutive tides in Adams Cove, the Great Bay estuarine system. New Hampshire, were examined for changes in water properties as the flood-front traversed the intertidal zone. The flood-front water temperature depended on the time of flooding as well as the sun's insolation. Flood-front water temperatures on warm days exceeded 34°C, some 15°C higher than the water observed in the deeper tidal channels. Flood-front salinities increased progressively across the intertidal zone regardless of local weather conditions, and were primarily controlled by mixing of surface waters with interstitial waters during the flooding process. Particulate matter concentrations were dependent on the interaction between small amplitude waves and varying intertidal bottom slope. Extreme variability in the particulate matter concentration across the tidal flat was partly caused by alternate resuspension and settling of fecal pellets composed of silty-clay aggregates which partly form the bottom sediment of the test area. The texture of the suspended particulate matter coarsens near shore, where wave resuspension became more effective on a steeper portion of the intertidal zone. References (40 items).

April, G.C., Ng, S., and Brett, C.E. Sediment Transportation and Deposition Models for Mobile Bay, Alabama. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:2092-2108.

The objective of this study is the application of hydrodynamic and material transport mathematical models for Mobile Bay in predicting sediment transport and deposition profiles within the bay system. Of particular importance are the seasonal variations of sediment distribution which are critically influenced by current patterns within the estuary. Both point and nonpoint sources of sediment will be included in the analysis. Results will be presented in two ways. The first or long term variations in sediment distribution will be assessed by correlation with tidal cycle average velocities at various locations within the bay. Calculated distribution patterns will be compared with observed bathymetic data over the past century. The net effect of the construction of the Mobile ship channel on deposition patterns within the bay will also be evaluated. Secondly, short-term variations in sediment transport and deposition resulting from man-made and natural disturbances will be analyzed using a sediment transport model. This model will include deposition, bulk fluid transport, and resuspension characteristics and will be capable of predicting localized, short-term sediment patterns from maintenance dredging operations within the bay. References (7 items).

Barthel, V. Stability of Tidal Channels Dependent on River Improvement. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1775-1789.

Many authors have dealt with the migration of sand in front of the German coast of the North Sea, especially the movement of sand banks and deep channels in the Weser Estuary. Investigations of selected cross sections show that movement goes on in some regions. The important shipping channel however has obtained a certain stability during the last 30-40 years, because the migration of sand has altered since extensive river improvement measures were begun in the Weser estuary. Current measurements in the investigation area demonstrate that concentrated tidal currents in the deep channels guarantee a sufficient clearance for shipping purpose. References (7 items).

Barwis, J.H., Perry, F.C., and LaGarde, V.E. Computer-Aided Photo Studies of Inlet Stability. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 1057-1072.

Computer-aided aerial photointerpretation can provide a quantitative review of past morphologic changes associated with tidal inlets. Such an approach, although limited in scope by the limitations of aerial photography, has a distinct advantage over the use of chart data. Charts are good references for long-term changes (decades or centuries), but are produced infrequently and are nearly always restricted to the subtidal zone. Vertical aerial photographs on the other hand are more applicable to short-term studies (years or seasons) and are in relative abundance for most inlets on the United States coastline. Additionally, aerial photographs provide a data source on size-location relationships of intertidal and supratidal geomorphic components. Computer evaluation of photointerpretive data can supply information such as the locations and configuration of the most commonly occurring natural channels, or delineate areas experiencing the highest shoaling rates. The objectives of this study were to prepare and evaluate photographic data on Fire Island Inlet, New York, describing planimetric positions of component features of the inlet system, and quantifying temporal shifts in the positions and areas of those features. Fire Island Inlet is located on the south shore of Long Island, approximately 60 km east of New York Harbor, and connects Great South Bay to the Atlantic Ocean. Prior to jetty construction in 1940, the inlet was characterized by an extremely high migration rate, having moved approximately 8 km westward in just over 100 years (2). Physical processes of the inlet system were reported by Saville (3), Panuzio (2), and Kaczorowski (4). The history of the inlet was reviewed by Gofseyeff (5), Panuzio (2), Shepard and Wanless (6), and Kumar and Sanders (7). Navigation through Fire Island Inlet is hindered by instability in the position and configuration of the main entrance channel, its associated ebb-tidal delta, and the digitate spit at Democrat Point. Between 1962 and 1973 alone, over 1.8 million yd^3 of sand was dredged from the 10-ft project navigation channel (Corps of Engineers, Summary of Activities, 1962-72). The secondary entrance channel located farther west, near Cedar Beach, is unsuitable for navigation because of its oblique orientation

with respect to the incidence angle of the predominant waves (Gil Nersesian, personal communication). The design of a suitable navigation channel was hindered by the existing state of knowledge of the processes involved in shoal formation, which did not permit a reliable prediction of inlet shoal-channel morphology. The New York District of the Corps of Engineers had designed an entrance channel and associated littoral trap to be maintained by dredging. In lieu of predicting future entrance channel configurations, quantitative review of historical morphologic changes was chosen as the most productive alternative. A 20-year historical photoanalysis, encompassing the effects of several major storms, was performed. Locations of shoals, channels, shorelines, berm crests, and dune scarps were digitized from semicontrolled photomosaics. These digitized data were then analyzed to rectify photos to identical scales, compute areas of inlet morphologic components, and determine the geographic frequency of occurrence for both ebb- and flood-tidal deltas. The results were used to help locate a project navigation channel such that maintenance dredging would be minimized. References (14 items).

Bayliss-Smith, T.P., et al. Tidal Flows in Salt Marsh Creeks. (See complete entry in Section I.)

Behrens, E.W. New Corpus Christi Pass, a Texas Tidal Inlet. SHORE AND BEACH, 47(4):9-14, October 1979.

Discussed are morphological development and history of a number of tidal inlets among the Texas coast. Stability of the Corpus Christi Pass is dealt with in particular. References (11 items).

Behrens, E.W., Watson, R.L., and Mason, C. Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History 1972-1973. US Army Corps of Engineers, General Investigation of Tidal Inlets, GITI Report 8, January 1977.

In 1972, a 2-mile channel was dredged through Mustang Island, Texas, USA, to increase water-exchange and fish migration between Corpus Christi Bay and the Gulf of Mexico. The pass' annual adjustment to tides, waves, and other forces was measured the first year following the opening. Hydraulic and sedimentary effects of the pass were studied by obtaining detailed bathymetric, topographic, and hydraulic surveys of the pass and adjacent gulf beaches. Daily wave observations provided information on the seasonal variability in wave height, period, and direction. References (46 items).

Bella, D.A. Diagnosis of Chronic Impacts of Estuarine Dredging. (See complete entry in Section V.)

Bella, D.A., and Williamson, K.J. Simulation of Sulfur Cycle in Estuarine Sediments. (See complete entry in Section VI.)

Bittencourt, A.C.D.P., et al. A Boat Specially Designed for Sediment Sampling in Estuaries and Bays. (See complete entry in Section VII.)

Bloom, H., and Ayling, G.M. Heavy Metals in the Derwent Estuary. (See complete entry in Section IV.)

Bohlen, W.F., Cundy, D.F., and Tramontano, J.M. Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations. (See complete entry in Section V.)

Bokuniewicz, H.J., et al. Field Study of the Effects of Storms on the Stability and Fate of Dredged Material in Subaqueous Disposal Areas. Technical Report D-77-22, US Army Engineer Waterways Experiment Station, November 1977.

Dredged sediment placed on the bottom of the Long Island Sound is subject to dispersion by the tidal stream, estuarine circulation, waves, and disturbances of the hydraulic flow field by storms. The tidal stream is the dominant source of energy for the resuspension and transport of sediments; waves do not contribute significantly to dispersion in water depths greater than 60 ft. Random fluctuations in the water velocity are detected at all depths. During a storm fluctuations in velocity increase in intensity and are important agents of sediment resuspension. Direct, wind-driven flow over the bottom is weak, but storm winds cause water level increases up to 3 ft above the usual tidal level. The energy available for sediment transport is then greatly increased. Repeated bathymetric surveys of a deposit of dredged material at the New Haven disposal site show that after initial self-consolidation of the mound, no significant changes in pile configuration occurred over a 3-year period, erosion of the deposit is not detected. The data obtained show that to best contain silt-clay dredged material, the disposal site should be on a naturally accreting mud bottom, the disposal operation should emplace a large volume of material on the site expeditiously, and the deposit should be built to an optimum configuration. References (24 items).

Bonnefille, R. Modeling in Coastal Engineering. (See complete entry in Section VI.)

Bonnefille, R. Present State of Knowledge: The Physical Behaviour of an Estuary and Its Implication on Estuary Dynamics. (See complete entry in Section I.)

Bopp, R.F., et al. Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York. (See complete entry in Section IV.)

Bouma, A.H., et al. Bedform Characteristics and Sand Transport in a Region of Large Sand Waves, Lower Cook Inlet, Alaska. In: Proceedings, Eleventh Annual Offshore Technology Conference, Dallas, II:1083-1094, 1979.

The central part of lower Cook Inlet, Alaska, is covered by marine bed forms of varying size and type. Swift tidal currents sweep the area, and assessment of the effects of these currents on the sandy bottom materials is essential to the industrial development of lower Cook Inlet. As part of the summer 1978 field program, a small area was selected for detailed observations. Surface currents showed

a rotary tidal current pattern with peak velocities of about 10 cm. Near the bottom a trimodal current-direction distribution was observed and unexpectedly low velocities were measured that were possibly due to obstruction by the bedforms. Sand transport along the bottom was observed only during the last hour of both the ebb-tidal and flood-tidal cycles of the spring tide, when velocities exceeded 30 cm at 1 m above bottom. The complex bathymetry of the large sand waves, characterized by rapid variations in the elevation of crests, complicates comparison of the anchor station results. References (12 items).

Bouma, A.H., et al. *Large Dunes and Other Bedforms in Lower Cook Inlet, Alaska.* In: Proceedings, 9th Annual Offshore Technology Conference, Houston, 1977, 1:79-89.

The surficial geology of lower Cook Inlet, Alaska, reveals: numerous fields containing bed forms of various sizes and types, a smooth bottom, sand patches, or boulders. High-velocity tidal currents exceeding 3-4 knots dominate the hydrodynamic environment. The fields normally are elongate in the axial direction of the inlet, parallel to the dominant tidal flow. Lengths of the fields normally exceed several kilometers; their widths range from a few hundred to a few thousand meters. Although ebb and flood surface currents in lower Cook Inlet are typically about 3.5 to 4 knots, currents of 5 to 6 knots are not exceptional. The most abundant group of bed forms are sand waves, some as large as sand ridges. Normally, smaller sand waves ride on their flanks, and opposing asymmetry may indicate opposite transport directions for the large and small waves. Dunes are less common and have not been seen covering large fields. Sand ridges, having their crests parallel to the current flow, are also present. References (35 items).

Brogdon, N.J., Jr. Mayport-Mill Cove Model Study, Report 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. (See complete entry in Section VI.)

Bruun, P. Design of Tidal Inlets on Littoral Drift Shores. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 927-945.

The paper presents an attempt to establish rational design procedures for tidal inlets on littoral drift shores. The principles outlined are a rational "Field and Physics" approach. Details are described in various references. References (27 items).

Caccese, L.A., and Spies, H.R. Barnegat Inlet, Nature Prevails! (See complete entry in Section V.)

Campbell, J.W., and Thomas, J.P., eds. Chesapeake Bay Plume Study: Superflux 1980. (See complete entry in Section VII.)

Carr, A.P., Heathershaw, A.D., and Blackley, M.W.L. Swansea Bay (Sker) Project: Progress Report for the Period August 1975 to July 1976. Taunton, U.K., Institute of Oceanographical Science, 1976, 28p. (Rep. No. 26). (Unpublished Manuscript.)

This report is an account of the research carried out between August 1975 and July 1976 in the Swansea Bay area. Considerable data were collected on waves and tidal currents in the bay and radioactive tracers were used in the study of sediment transport off Sker Point. Geological samples for surface sediments were examined both from the beach and offshore. Variations in the coastline since the mid-nineteenth century were also assessed based on cartographic evidence. The report also contains the plans for work to be done in the next stage of the project.

Chapman, P.M. Measurements of the Short-Term Stability of Interstitial Salinities in Subtidal Estuarine Sediments. (See complete entry in Section III.)

Choudhury, T.K. Use of Unconventional Materials in the Construction of Nupur Spurs, River Hooghly. (See complete entry in Section V.)

Christensen, E.R., and Scherfig, J. Metals from Urban Runoff in Dated Sediments of a Very Shallow Estuary. (See complete entry in Section IV.)

Collins, M., Ferentinos, G., and Banner, F.T. The Hydrodynamics and Sedimentology of a High (Tidal and Wave) Energy Embayment (Swansea Bay, Northern Bristol Channel). (See complete entry in Section I.)

Cooke, J.C. Dispersal of Microfungi in the Thames River Estuary of Eastern Long Island Sound. (See complete entry in Section VII.)

Costa, S.L., and Isaacs, J.D. The Modifications of Sand Transport in Tidal Inlets. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 946-965.

This study extends the concepts of sand transport modification in tidal inlets from model experiments to possible field scale applications. The extension is made by appealing to existing data, for both scales, from unidirectional stream and flume flows. The differences between such flows and the tidal flows of inlet channels are recognized. The difficulties in identifying scale effects in general for the two-phase phenomena persist. However, the similarities between the data of different scales yield some confidence in making qualitative (and probably some quantitative) extensions from model to field scales. The reason for such similarities seems to be a result of interactions between the flow and the various types of bed forms. This extension from model to field scales, although generally of an empirical nature, demonstrates that the sand transport of many natural inlets appears to be governed by fairly high powers of mean channel velocity. Thus, small changes to this velocity, from whatever source, may lead to profound changes in the sand transport characteristics of inlets in both model and field scale systems. References (14 items).

Culver, S.J. Differential Two-Way Sediment Transport in the Bristol Channel and Severn Estuary, U.K. MARINE GEOLOGY, 34(1-2): M39-M43, January 1980.

The main sediment transport paths are briefly described; coarse sediment is transported in a generally westward direction and fine sediment in a generally eastward direction. The concept of differential two-way sediment transport is introduced and applied to the modern Bristol Channel area. This phenomenon is considered to be of significance in interpreting ancient sediment transport patterns and shelf configurations.

Cundy, D.F., and Bohlen, W.F. A Numerical Simulation of the Dispersion of Sediments Suspended by Estuarine Dredging Operations. (See complete entry in Section VI.)

Czerniak, M.T. Inlet Interaction and Stability Theory Verification. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 754-773.

Due to a series of happenstance events involving the opening, closing, dredging, and jettying of Moriches and Shinnecock Inlets, New York, and due to the interconnecting nature of their bays, some unique inlet behavior has been observed. This includes the "hydraulically unstable" behavior of Moriches Inlet in both the "scour" and "shoaling" modes, a change with time in the hydraulic stability curve governing the behavior of Moriches Inlet, and evidence of hydraulic interaction between the two inlets as a result of changing bay tidal dynamics. The purpose of this paper is to explain the complex history of Moriches and Shinnecock Inlets in terms of the stability theory presented by O'Brien and Dean (1972). With appropriate extensions, it was found that their stability model qualitatively explained all observed inlet behavior. As such, this case study lends considerable support to the theory by providing some verification to parts of the theory which heretofore appear to have had little support from field studies. References (20 items).

Dalrymple, R.W., Knight, R.J., and Lambiase, J.J. Bedforms and Their Hydraulic Stability Relationships in a Tidal Environment, Bay of Fundy, Canada. NATURE, 275(5676):100-104, September 14, 1978.

Three intermediate to large-scale bed configurations are recognised (from intertidal sand bodies in the Bay of Fundy), each with a discrete hydraulic stability field. Type 1 megaripples ('bars') form at lower flow velocities than Type 2 megaripples ('dunes'), whereas Type 2 megaripples and megarippled sand waves are separated primarily by grain size. Megarippled sand waves occur only in sands coarser than 0.308 mm. References (35 items).

Daly, M.A., and Mathieson, A.C. Nutrient Fluxes Within a Small North Temperate Salt Marsh. (See complete entry in Section IV.)

Davies, C.M. Evidence for the Formation and Age of a Commercial Sand Deposit in the Bristol Channel. ESTUARINE AND COASTAL MARINE SCIENCE, 11(1):83-99, July 1980.

Periodic surveys have been made of Holm Sand, a Holocene deposit incorporating One Fathom Bank and part of Mackenzie Shoal in the Bristol Channel (British Admiralty Chart, 1182). The deposit is worked for sea-dredged aggregate, primarily building and concreting sands, although the latter are becoming depleted. The surveys show that the deposit lies on irregular pre-Holocene substrate and is incorporated as two suites of sand waves: large, mainly asymmetrical, outer sand waves and smaller, symmetrically variable, inner sand waves. Sediments are classified into seven types (A-G), outer sand waves being formed in gravelly sands and sandy gravels (types C-F), and inner sand waves in unimodal medium sands (types A and B). It is suggested that sand wave scale is related to transport mode: transport of inner waveform sediments is mainly as suspended load, whereas outer waveform sediments are transported part as bed load, part as suspended load. A progressive sequence of profiles is evident in outer sand waves and their alignment and mobility indicate that Holm Sand sediments are derived from channels to the northwest and southwest. This sequence, together with a progressive fining in mean sizes towards the deposit axis, suggests that the structure could have evolved during the (Holocene) Sub-Atlantic period. *References* (20 items).

Davies, J.L. Geographical Variation in Coastal Development, edited by K.M. Clayton. New York, Hafner Publishing Company, 1973. 204p.

This book examines ways in which the morphological development of coasts varies from one part of the world to another, and tries to isolate the factors involved. These factors include global and smaller scale geological structures, lithology, subaerial climates, waves and tides regimes, and the effects of a wide range of plant and animal organisms. Throughout, an attempt is made to look at things from a world viewpoint and to suggest the existence of broad patterns on a global scale. Although the special importance of biological effects in the tropics has long been recognized, coastal processes generally have been thought of as being largely independent of climate, in contrast to geomorphological processes on land. This book concludes that, while the fundamental influence of geological structure and lithology and the legacies derived from past conditions must be recognized, it is possible to distinguish broad climatically determined zones within which shore development varies significantly. Bibliography (382 items).

DeAlteris, J., McKinney, T., and Roney, J. Beach Haven and Little Egg Inlets, A Case Study. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, 1881-1898.

A comprehensive investigation of coastal processes active within and in the vicinity of Beach Haven and Little Egg Inlets was completed as part of the Coastal Processes Investigation

for the proposed Atlantic Generating Station. The suspected complex nature of this dual natural inlet system was documented and a process-response model is presented to relate the more significant physical forcing functions to observed morphologic and hydraulic changes. A rising sea level, a net littoral drift from the north, and the sediment scouring power of the flow in the two main channels serving the tidal basins are the principal factors related to the geographic and hydraulic stability of the system. The results of the study can be used to evaluate the potential impact, if any, of the proposed Atlantic Generating Station on the adjacent coastal environment. References (12 items).

Dean, R.G., and Perlin, M. Coastal Engineering Study of Ocean City Inlet, Maryland. (See complete entry in Section V.)

DeGroot, A.J. and Salomons, W. Influence of Civil Engineering Projects on Water Quality in Deltaic Regions. (See complete entry in Section IV.)

DeLaune, R.D., and Patrick, W.H., Jr. Rate of Sedimentation and Its Role in Nutrient Cycling in a Louisiana Salt Marsh. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 401-412, 1980.

The Gulf Coast salt marshes in the deltaic plain of the Mississippi River are in a rapidly subsiding zone where accretion processes are important for maintenance of the marsh surface within the intertidal range. Incoming sediment is essential for maintaining the marsh surface and for supplying nutrients for plant growth. In an area that is apparently maintaining its surface with respect to sea level, ^{137}Cs dating shows an accretion rate of 1.35 cm/year. In an adjacent deteriorating marsh the sedimentation rate is 0.75 cm/year, not enough to compensate for subsidence. The incoming sediment also is a major source of plant nutrients for Spartina alterniflora, with inputs as great as 231, 23.1 and 991 kg/ha of nitrogen, phosphorus and potassium, respectively. Mineralization of these nutrients in the sediment provides a significant portion of the plant's requirements, but growth of salt marsh plants is still limited by available nitrogen, as addition of nitrogen fertilizer confirms. References (13 items).

Demarest, J.M., II, and Kraft, J.C. Protection of Sedimentation Patterns in Breakwater Harbor, Delaware. SHORE AND BEACH, 47(2):17-24, April 1979.

Planning and design for the redevelopment of Breakwater Harbor as a shipping base are discussed, and sedimentary processes of the area are considered. The paper reviews present knowledge of the physical setting and geological changes. Projections of change for the 15- to 25-year future are presented. References (11 items).

De Vries, M. Modelling of Sediment Transport: Link in a Chain. Delft, The Netherlands, Delft Tech. Univ., Report No. 77-1, 1977, 10p. (Reprint of the invited lecture presented at the XVIIth IAHR Congress, Baden-Baden, Fed. Repbl. Germany: Aug. 15-19, 1977.)

This paper is a brief general review of the state of the art of modelling sediment transport caused by currents. This covers both mathematical and physical models of sediment transport in rivers. References (10 items).

Dietrich, G., et al. General Oceanography, an Introduction. (See complete entry in Section I.)

Downing, J.P., Jr. Particle Counter for Sediment Transport Studies. Journal of the Hydraulics Division, Proceedings, ASCE, 107 (HY11):1455-1465, November 1981.

An acoustic instrument for the measurement of the mass transport of sand-sized sediment particles in laboratory and natural transport systems has been developed. The instrument consists of an electromechanical transducer for the detection of sediment particles entrained in a moving fluid (air or water) and an electronic circuit which counts the transient signals produced when particles impact the transducer. By virtue of the principle of detection, instrument response to fine-grained sediment (silt and clay) and low-density material is negligible. Laboratory tests and field experiment conducted in a sand-bedded stream demonstrate that the instrument responds systematically to the mass flux of particles and therefore is potentially useful for investigations of bed-load transport. The instrument is best suited for studies of transport systems characterized by high transport rates and flow velocities and having well-sorted bed material. References (10 items).

Driese, S.G., Byers, C.W., and Dott, R.H., Jr. Tidal Deposition in the Basal Upper Cambrian Mt. Simon Formation in Wisconsin. JOURNAL OF SEDIMENTARY PETROLOGY, 5(12):367-381, June 1981.

The Upper Cambrian Mt. Simon Formation (0-65 m thick) is a basal quartz arenite exposed in west-central Wisconsin. A detailed field investigation of the physical and biogenic sedimentary structures of the Mt. Simon has led to the recognition of three distinct lithofacies. The lower one unconformably overlies Precambrian basement rocks. It consists of medium- to very large-scale sets of tabular and trough cross-bedded, medium- to very coarse-grained sandstone and pebbly sandstone with minor intercalated horizontal beds of very fine- to medium-grained sandstone, siltstone, and shale. Sparse examples of Skolithos and Arenicolites are present. This facies consists of a very thin sequence of possible braided-fluvial and marine foreshore deposits, overlain by probable marine shoreface and tidal channel deposits. Much of the facies seem to represent shallow subtidal deposition in a relatively high-energy regime. The middle lithofacies consists of two distinctly different subfacies, which probably were deposited in a low tidal flat setting. The higher energy subfacies consists of small- to

medium-scale sets of tabular and trough cross-bedded, fine- to coarse-grained sandstones containing distinct zones dominated by Skolithos and Arenicolites. This subfacies probably represents deposition in meandering tidal channels. The lower energy subfacies consists of thin-bedded, horizontally laminated and ripple cross-laminated, very fine- to medium-grained sandstone, siltstone, and shale, with common specimens of Criziana, Rusophycus, and Planolites. This subfacies probably represents deposition on lower energy tidal flats adjacent to the tidal channels. The upper lithofacies consists predominantly of structureless, densely bioturbated, very fine- to coarse-grained sandstone containing abundant specimens of Skolithos. The upper few meters of the facies consist of small- to medium-scale sets of trough cross-bedded, very fine- to coarse-grained sandstone with layers of disarticulated valves of the brachiopod Obolus. The upper facies probably represents deposition on tidal flats, perhaps in a mid-tidal flat setting, characterized by slower sedimentation rates, a correspondingly higher degree of bioturbation, persistent reworking of shelled macrobenthos, and periodic subaerial exposure. The Mt. Simon Formation is interpreted as a largely progradational (regressive), shoaling- and fining-upward tidal sequence. A marine interpretation is supported by the widespread occurrence of marine trace fossils within this unit. Evidence for a tidal origin is seen in the presence of unimodal cross-strata associated with reactivation surfaces, compound cross-strata, numerous scour and truncation surfaces lined with intraformational conglomerates, common clay drape laminae separating sets of cross-strata, interference and flat-topped ripple marks, and desiccation cracks. Sedimentation continued without apparent interruption as the overlying Eau Claire Formation was deposited, also under tidal influence. Recent reinterpretations of other basal Cambrian cratonic quartz arenites, together with this new interpretation for the Mt. Simon Formation, suggest that the long-held concept of basal transgressive sandstones deposited as blankets across the craton may be too simplistic for deposition in braided-fluvial, marginal marine (tidal flat-tidal channel), and marine foreshore and shoreface environments seems indicated. References (41 items).

Duinker, J.C., and Nolting, R.F. Dissolved and Particulate Trace Metals in the Rhine Estuary and the Southern Bight. (See complete entry in Section IV.)

Ecker, R.M., Sustar, J.F., and Harvey, W.T. Tracing Estuarine Sediments by Neutron Activation. (See complete entry in Section VII.)

Farmer, R.C., and Waldrop, W.R. A Model for Sediment Transport and Delta Formation. (See complete entry in Section VI.)

Feuillet, J.-P., and Fleischer, P. Estuarine Circulation: Controlling Factor of Clay Mineral Distribution in James River Estuary, Virginia. JOURNAL OF SEDIMENTARY PETROLOGY, 50(1):267-279, March 1980.

A study of clay minerals in bottom sediments of the James River estuary, Virginia, was performed to determine the predominant factors influencing their distribution. Analyses of 151 samples indicate that the factors of differential settling, flocculation, and diagenesis have minor or no effects, whereas estuarine circulation exerts the dominant influence on the clay mineral distribution. Two characteristic clay suites are present in the James River estuary; the James River clay suite is kaolinite-illite-dioctahedral vermiculite, and the Chesapeake Bay entrance bears an illite-chlorite montmorillonite suite. Mixing between the two suites occurs as a result of the estuarine circulation dynamics, which cause upstream transport of marine sediments. The upstream limit of mixing is located in the region where the surface of no net motion intersects the river bottom. Mutual dilution of the two suites by estuarine mixing is the predominant factor governing the clay mineral distribution of all clay minerals identified. References (48 items).

Finley, R.J., and Baumgardner, W., Jr. Interpretation of Surface-Water Circulation, Aransas Pass, Texas, Using Landsat Imagery. (See complete entry in Section I.)

Fisher, J.S., and Pickral, J.C. Transportation of Organic Detritus in Estuaries. In: Proceedings, 25th Annual Hydraulics Division Specialty Conference on Hydraulics in the Coastal Zone, New York, ASCE, 1977, 344-351.

The entrainment of benthic particulate organic detritus is predictable from a Shields diagram. The samples were collected from a small tidal salt marsh. A measurement of size and fall velocity appears to be sufficient to estimate the shear velocity at the initiation of motion. Further work is needed to clarify the effect of shape on this relationship. References (5 items).

Fisher, T.R., Carlson, P.R., and Barber, R.T. Sediment Nutrient Regeneration in Three North Carolina Estuaries. ESTUARINE, COASTAL AND SHELF SCIENCE, 14(1):101-116, January 1982.

Sediment-water column exchanges of oxygen, ammonium, nitrate, and phosphate were measured in three North Carolina estuaries by means of diver-installed chambers placed in the sediments. Significant fluxes were observed in two of the estuaries characterized as organic-rich, depositional environments. The third was a highly flushed system dominated by sandy to shelly muds, and no measurable fluxes were found. In the former two estuaries, fluxes were weakly influenced by temperature, and ammonium and phosphate fluxes were highly correlated. Nitrate fluxes were very small, and phosphate sorption was frequently observed at temperatures less than 15° C. Data from this research and the literature show a general correlation of sediment inorganic N and P fluxes and the computed water column N and P uptake, demonstrating that sediments supply, as an annual average, 28-35 percent of the N and P required for the primary production of shallow marine systems. References (38 items).

FitzGerald, D.M., and FitzGerald, S.A. Factors Influencing Tidal Inlet Throat Geometry. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 563-581.

Tidal inlets along depositional coasts exhibit diverse throat cross sections due to varying physical processes and geologic histories. The relative importance of tidal energy and wave regime greatly affects the geometry of inlet throats. On the Georgia coast, tidal ranges greater than 1.5 m to 2.0 m produce large tidal prisms and flow areas. The inlets on this coast generally have average depths of greater than 7 m. In contrast, inlets are relatively shallow along coasts which are dominated by wave processes. Average depths of inlets in North Carolina, Florida, and the Gulf Coast are less than 6 m, for example. A study of central South Carolina inlets has shown that the symmetry of the inlet throat is related to three controlling factors: 1) the meandering of the channel thalweg, 2) the shoreline configuration, and 3) the dominant longshore transport direction. The sedimentological nature of the inlet throat can also have an important influence on its geometry. During the past century, most of these inlets have narrowed and deepened due to spit accretion on both sides of the inlet. Changes in their flow areas through time are attributed in part to the filling in of the marshes and also to the construction of the Intracoastal Waterway, which changes the drainage area of the system. Cross-sectional profile data from Price Inlet, S. C., over a 3-year period from July 1974 to July 1977, and an in-depth study on 29 June 1977, indicate that the inlet responds quickly to changing flow conditions and more slowly to changes in the ebb-tidal delta. A good correlation has been found between inlet throat cross-sectional area and the flood tidal range directly preceding the running of the cross-sectional profiles. References (29 items).

Fitzgerald, D.M., Nummedal, D., and Kana, T.W. Sand Circulation Pattern at Price Inlet, South Carolina. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1868-1880.

A sand circulation pattern has been determined for Price Inlet, South Carolina, using wave refraction diagrams, littoral process measurements, bed-form orientations and inlet hydraulic data. The dominant process acting on the ebb-tidal delta is wave swash which impedes the ebb-tidal currents and augments the flood-tidal currents. This produces a net landward transport of sand on the ebb-tidal delta as evidenced by the landward migrating swash bars. Bed-form orientations and velocity measurements taken on the swash bars also support this conclusion. Countering the general landward transport direction is the ebb dominance of the main channel. This dominance can be explained by higher inlet efficiency at low water than at high water. Consequently, bay tide phase lag is larger at high than at low water resulting in a longer flood duration. This causes higher mean ebb-tidal currents and a consequent larger potential net ebb transport of sand. This inlet characteristic explains why little sand is transported inside the inlet, why the throat remains scoured, and why sand entering the main channel is carried seaward. References (15 items).

Floyd, C.D., and Druery, B.M. Results of River Mouth Training on the Clarence Bar, New South Wales, Australia. (See complete entry in Section V.)

Frenet-Robin, M., and Ottmann, F. Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary. ESTUARINE AND COASTAL MARINE SCIENCE, 7(5):425-436, November 1978.

Samples of kaolinite, illite, and montmorillonites were agitated with solutions of mercuric chloride at different salinities, clay turbidities, and concentrations of mercuric ions. The rates of adsorption and maximum quantities adsorbed were obtained in terms of these factors. Clays with known quantities of adsorbed mercury were agitated with fresh and salt water to measure rates of desorption. The values obtained are compared with an analysis of the water and sediments of the Loire Estuary, based on a large number of samples taken over the period 1972-1975. Mercury pollution has considerably decreased over this period. References (13 items).

Gardner, L.R. Geomorphic and Hydraulic Evolution of Tidal Creeks on a Subsiding Beach Ridge Plain, North Inlet, S.C. MARINE GEOLOGY, 34(3-4):M91-M97, February 1980.

Stratigraphic and geomorphic features of a small marsh basin in an early stage of evolution under conditions of slow submergence is described. These features suggested that the tidal creek draining this basin was originally a freshwater stream that gradually adjusted its hydraulic geometry to an increasing volume of tidal discharge imposed by submergence. A generalized model of the evolution of hydraulic geometry in response to submergence is presented as a complement to the classical Mudge-David model of marsh evolution.

Giese, E. Investigation of Training Structures in a Tidal Model with Movable Bed. (See complete entry in Section VI.)

Giese, G.L., Wilder, H.B., and Parker, G.G., Jr. Hydrology of Major Estuaries and Sounds of North Carolina. (See complete entry in Section IV.)

Goldberg, E.D., et al. Pollution History of the Savannah River Estuary. (See complete entry in Section IV.)

Gordon, R.B., and Spaulding, M.L. A Nested Numerical Tidal Model of the Southern New England Bight. (See complete entry in Section VI.)

Goyal, S.M., Gerba, C.P., and Melnick, J.L. R+ Bacteria in Estuarine Sediments. (See complete entry in Section IV.)

Graf, W.H. Hydraulics of Sediment Transport. New York, McGraw-Hill Book Company, 1971, 513p.

The purpose of this book is to aid in the understanding and formulation of movement and transportation of solid granular particles in or through liquid bodies. The book is divided into four parts: A Short History of Sediment Transport, Hydrodynamics of Fluid-Particle Systems, Sediment Transport in Open Channels, and Sediment Transport in Closed Pipes. References are given at the end of each part.

Great Britain, Hydraulics Research Station, Wallingford. Thames Estuary Flood Prevention Investigation; The Effect of a Half Tide Barrier at Either Woolwich or Blackwall on Siltation in the Estuary. (See complete entry in Section V.)

Gregory, P. The Dying Estuary. (See complete entry in Section V.)

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. (See complete entry in Section I.)

Haller, D.L. Demonstration of Advanced Dredging Technology Dredging Contaminated Material (Kepone) James River, Virginia. (See complete entry in Section V.)

Hamaguchi, S. Pollution Studies at Tsu-Matsuzaka Harbor and Removal of Sediment at Estuaries near It. (See complete entry in Section V.)

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. (See complete entry in Section I.)

Harriss, R.C., Ribelin, B.W., and Dreyer, C. Sources and Variability of Suspended Particulates and Organic Carbon in a Salt Marsh Estuary. *In:* Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 371-384, 1980.

Juncus roemerianus salt marsh ecosystems bordering the Northeast Gulf of Mexico are an apparent source of suspended particulates to adjacent coastal waters. More than 98 percent of the detrital particulates collected from ebb tide waters are comprised of amorphous aggregates, derived primarily from organic films produced by benthic microflora. Vascular plant fragments from the predominant macrophyte in the marshes, *Juncus roemerianus*, are not an important source of detritus to the estuarine water column. Tidal cycle, light levels, and weather-related episodic phenomena all influence the production and distribution of suspended particulates and organic carbon in estuarine waters. The transport of dissolved organic carbon from low salinity marsh source areas to relatively high salinity offshore waters exhibits linear dilution characteristics. Particulate organic carbon exhibits a nonlinear relationship to salinity in estuarine waters, primarily due to the influence of sediment resuspension by water column turbulence. The data from this study offer an opportunity to explore the relative importance of components of variability in the suspended particulate distribution through water-quality simulation modeling. References (23 items).

Heathershaw, A.D., and Carr, A.P. Measurements of Sediment Transport Rates Using Radioactive Tracers. (See complete entry in Section VII.)

Hill, D.E. Soils in Tidal Marshes of the Northeast. SOIL SCIENCE, 133(5):298-304, May 1982.

Tidal marshes, which occupy 288,000 hectares of the coastal fringe of the Northeast, ar extensive on the coastal plain from Maryland to New Jersey and thence occur intermittently along the coast from New York to Maine. They have been forming since deglaciation about 12,000 years ago, as the apparent sea level rose upon the coast. Variations in thickness of inorganic and organic facies are due to the interaction of such geologic processes as coastal subsidence, isostatic rebound, and eustatic rise in sea level. Greater thickness of organic facies are evident in New Englend, and their span of accumulation is recorded as about 4,000 years and corresponds to the time when the apparent rise in sea level halved its former rate and promoted more widespread colonization of mud flats. Sulfihemists dominate the coastal marshes of glaciated New England, except Rhode Island, and Sulfaquents appear to be widespread along the coastal plain from New Jersey to Maryland. Hydraquents and Halaqualfs (provisional) are also found in estuarine marshes surrounding Delaware and Chesapeake Bays. The organic materials of tidal Histosols are dominately hemic. Sulfur, concentrated from seawater by plants and microorganisms growing in a carbon-rich, oxygen-poor environment, accumulate within 1 m of the surface, forming sulfidic materials. They form in both organic and inorganic facies of tidal marshes bathed in saline and brackish waters. Total sulfur appears to be correlated fairly well with organic carbon among Sulfihemist pedons. Examination of tidal marsh soils in the field and laboratory suggests a need for modification of the present classification of tidal Histosols. References (14 items).

Hirschberg, D.J., and Schubel, J.R. Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay. ESTUARINE AND COASTAL MARINE SCIENCE 9(6):771-784, December 1979.

^{210}Pb and ^{137}Cs dating of sediment cores from the extreme northern Chesapeake Bay has revealed that episodic sedimentation events associated with Susquehanna River floods in 1936 and 1972 have contributed half of all sediment deposited in this area since 1900. Much of this sediment is derived from resuspension of sediment trapped along the riverbed during years of normal riverflow. The normal ^{210}Pb determined sedimentation rate in this region, excluding flood events, is 0.45 cm^{-1} which is in good agreement with rates previously estimated from sediment budget models. The long-term sedimentation rate is probably twice this value which is in agreement with drainage basin sediment yield and denudation rate studies. References (26 items).

Hubbard, D.K. Changes in Inlet Offset Due to Stabilization. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1812-1823.

Available evidence indicates southward littoral transport through the Merrimack Embayment. In apparent contradiction, the beach on the southern (Plum Island) side of the inlet has built seaward of the updrift beach. This phenomenon is related to a balance between storm and fair weather conditions. Wave observations under a variety of surf conditions show that during storms, sand is transported southward along the face of the nearshore bar fronting Plum Island. During calm periods sand is moved northward along the beach until it is trapped by the southern jetty and removed from the then active tidal current transfer system. Using discharge data and wave measurements from the Merrimack Inlet area, Bruun's bypassing coefficient was computed for storm and fair weather conditions. During storms, the bar bypassing observed in the field was clearly indicated. During calmer periods tidal current transfer was predicted. This relationship is considered only an approximation as it does not consider many important physical parameters (grain size, nearshore slope, wave type, etc.). References (15 items).

Hubbard, D.K., Barwis, J.H., and Nummedal, D. Sediment Transport in Four South Carolina Inlets. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 582-601.

Hydrographic studies were conducted at four South Carolina tidal inlets to *identify zones* of active landward and seaward transport, and to document the processes responsible for this dominance. Currents and tidal elevations were monitored for 25 hours at each inlet during varying tidal phases. At Murrells Inlet, wave observations and suspended sediment measurements were made along the wide bar extending obliquely across the throat section. These measurements were used to assess the contributions of wave-induced sediment transport to the system. Studies indicate that South Carolina inlets are partitioned such that the main channel is ebb dominant, while upper bar surfaces are dominated by landward flow, as described by Hayes et al. (1973). Furthermore, the ebb dominance of the current flow through the throat is more a function of the degree of marsh development in the back-barrier lagoon than the shape of the inlet cross section. Landward transport on upper bar surfaces can be affected in two ways. First, inlet morphology or time-velocity asymmetry can result in landward flow dominance (and therefore sediment transport) over the shoal. Alternately, flood currents can reduce shoaling effects on incoming waves and allow larger waves to pass onto the bar and break in shallower water than usual. On the ebb, currents increase the shoaling effects on the waves and cause them to break on the distal portions of the bar or, if on the upper bar, in deeper water (relative to wave height) than normal. Thus, suspended sediment concentrations in the water column over the bar are higher on flood than during ebb (flood = 5.36 g/l; ebb = 3.08 g/l). Landward transport across the bar at Murrells Inlet was computed to be 1,500,000 to 1,800,000 m^3/year. This is much higher than net longshore transport rates (128,000 m^3/year; Kana, 1976) or gross longshore transport rates (350,000 m^3/year; Finley, 1976) calculated for nearby beaches. This indicates a partly closed inlet-sediment circulation system which is independent of wave-induced transport on adjacent beaches. Transport rates calculated for the channel section using the equation of Maddock (1969), which relates load to the cube of the velocity, are an order of magnitude too high when compared to landward transport rates across the upper bar surfaces. The value of such equations in the marine environment is therefore questioned. References (30 items).

Hudson, R.Y., et al. Coastal Hydraulic Models. (See complete entry in Section VI.)

Humphries, S.M. Morphologic Equilibrium of a Natural Tidal Inlet. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 734-753.

A tidal inlet maintains a dynamic equilibrium between the scour of tidal currents and the deposition of sand delivered by the longshore transport. Through periodic monitoring of channel cross-sectional areas and nearby beach profiles at North Inlet, South Carolina, the nature of this equilibrium was investigated from June 1975 to May 1976. The results demonstrate contemporaneous reduction in channel cross-sectional areas and beach erosion, or, increase in channel cross-sectional area and beach accretion. Two cycles of erosion and deposition occurred between January and May 1976. Beach erosion and inlet infilling appear to occur at a faster rate than the reconstruction of the beach and scour of the inlet which takes many weeks. The mechanism of inlet fill and subsequent erosion is important for determining the pathway of sediment bypassing of an inlet, in that the tidal scour will bring most of the sand from the inlet bottom onto the downdrift swash platform. North Inlet has a history of southward migration and has been stable at its present location for the past 12 years. Between July 1974 and May 1976, the gross transport rate at a profile location 2 km north of the inlet averaged 830,000 m^3/year with a net annual transport to the south of 240,000 m^3. From nine profile locations on the beaches adjacent to North Inlet, data also show dominant longshore transport to the south. An estimated updrift beach erosion of 81,000 m^3/km and downdrift beach accretion of 15,400 m^3/km occurred between June 1975 and May 1976. The morphologic change of the Debidue Island recurved spit confirms the updrift erosion. During the same time period, landward swash bar migration and bar welding onto the beach of North Island are the morphological expressions of downdrift accretion. References (12 items).

Ianniello, J.P. Comments on Tidally Induced Residual Currents in Estuaries: Dynamics and Near-Bottom Flow Characteristics. (See complete entry in Section I.)

Jain, S.C., and Kennedy, J.F. An Evaluation of Movable-Bed Tidal Inlet Models. (See complete entry in Section VI.)

Jain, S.C., and Kennedy, J.F. Movable Bed Tidal Inlet Models. (See complete entry in Section VI.)

Jansen, R.H.J. The In Situ Measurement of Sediment Transport by Means of Ultrasound Scattering. (See complete entry in Section VII.)

Jones, C.P., and Mehta, A.J. A Comparative Review of Sand Transfer Systems at Florida's Tidal Entrances. (See complete entry in Section V.)

Jones, C.P., and Mehta, A.J. Inlet Sand By-passing Systems in Florida. (See complete entry in Section V.)

Jones, G.B., and Jordan, M.B. The Distribution of Organic Material and Trace Metals in Sediments from the River Liffey Estuary, Dublin. (See complete entry in Section IV.)

Kadib, A.A. Sedimentation Problems at Offshore Dredged Channels. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1756-1774.

Because of the complexity of the mechanism of sediment-flow interaction and the lack of available practical methods for estimating the sediment transport rate under waves and current action, it is felt that a simple and rational method is needed for describing sediment behavior at offshore dredged channels and estimating accretion rates. It is hoped that this paper contributes to the answer of this problem. The paper describes the mechanism of sediment deposition and presents a simple method for estimating the rate of annual maintenance dredging. The effect of using a submerged breakwater for relieving the sedimentation problem within the dredged channel is also presented. References (12 items).

Kelley, J.T. Size Distribution of Disaggregated Inorganic Suspended Sediment: Southern New Jersey Inner Continental Shelf. JOURNAL OF SEDIMENTARY PETROLOGY, 51(4):1097-1101, December 1981.

Size analyses of southern New Jersey inner shelf suspended sediment performed by a combination of pipette and Coulter Counter methods suggest that as much as 75 percent of the dispersed inorganic suspensate is finer than 0.5 μm. The size distribution of inner shelf suspended sediment exhibited little variation, although larger quantities of silt were encountered near turbid, tidal inlets. Previous textural analyses of inorganic suspended sediment by microscope or electronic particle sizer may have underestimated the proportion of grains smaller than 0.5 μm. Fine-grained sediment size analyses which ignore grains finer than 0.5 μm may neglect a significant portion of the sediment mud fraction. References (31 items).

Kendrick, M.P., and Derbyshire, B.V. Factors Influencing Estuary Sediment Distribution. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:2072-2091.

The tidal Thames in the U.K. exemplifies a relatively well-documented estuary which for many years has been studied in the field, on physical and mathematical models, and through laboratory tests on sediment. Using some of the results of these studies, the authors attempt to demonstrate how various factors affect sediment distribution: (a) in the short-term throughout a single tide; (b) during the slightly longer course of the bi-monthly spring-to-neap cycle; (c) as a result of annual seasonal variations; and (d) in the longer term over a period of 30 years or more. Finally, the paper illustrates the impact that civil engineering works can have on such an estuary. References (4 items).

Kinsman, B., et al. Transport Processes in Estuaries: Recommendations for Research; Final Report. State University of New York at Stony Brook, Marine Sciences Research Center, Reference 77-2, Special Report No. 6, April 1977.

A review of the state of current knowledge of physical transport processes of water, salt, and fine-grained suspended sediments in estuaries is presented. Other items discussed are the manpower and material necessary for the field experiments on which the solution of important unresolved problems must depend. Bibliography (6 items).

Klein, G.D., and Ryer, T.A. Tidal Circulation Patterns in Precambrian, Paleozoic, and Cretaceous Epeiric and Mioclinal Shelf Seas. GEOLOGICAL SOCIETY OF AMERICA BULLETIN, 89(7): 1050-1058, July 1978.

According to some workers, ancient epeiric and mioclinal shelf seas should have lacked normal astronomical tides because of their shallow depths and great size. A variety of sedimentological and paleontological evidence, however, indicates that Precambrian, Cambrian, Ordovician, and Cretaceous strata of western North America, Carboniferous strata of the eastern United States, Precambrian and Cambrian strata of Scotland, and Precambrian and Ordovician strata of South Africa, which were, in part, deposited in such shallow seas, contain extensive tidalites. On Holocene continental shelves, a positive correlation exists between shelf width, ridal range, and tidal current velocity; the widest shelves are characterized by the greatest tidal ranges and the greatest tidal current velocities. This relationship is generally applicable to ancient epeiric and mioclinal shelf seas, and we conclude that ancient shallow seas were, in fact, characterized and dominated by tides and by tidal circulation patterns. Therefore, sedimentological and paleontological evidence of tidal influences should be sought more widely is strata that accumulated in such seas. References (61 items).

Komar, P.D., and Terich, T.A. Changes Due to Jetties at Tillamook Bay, Oregon. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1791-1811.

Bayocean Spit, separating Tillamook Bay from the Pacific Ocean on the north Oregon coast, underwent severe erosion following

construction of a north jetty at the bay entrance in 1914-17. The authors reexamine the shoreline changes and conclude that all of the changes resulted from local rearrangements of the beach due to the disrupted equilibrium following jetty construction, but at the same time maintaining an overall condition of zero net littoral drift. This interpretation is supported by other evidence that indicates a near-zero net drift on this portion of the Oregon coast. With the completion in 1974 of a new south jetty, the result has been further realignments of the shoreline with accretion and shoreline advance immediately south of the south jetty. This provides further confirmation that a zero net littoral drift exists in the area. This study also demonstrates the effects of building only a single jetty rather than a pair of jetties. Following construction of the north jetty, the outer bar or ebb-tide delta at the Tillamook Bay inlet grew appreciably in size. Sand deposited there came from erosion of Bayocean Spit farther to the south. The shoal growth pushed the main channel at the entrance against the north jetty where it has remained since jetty completion. In the process, the channel became much deeper and narrower than the channel geometry prior to jetty construction. References (14 items).

Leatherman, S.P., ed. Barrier Islands: From the Gulf of St. Lawrence to the Gulf of Mexico. (See complete entry in Section I.)

Luck, G. Inlet Changes of the East Frisian Islands. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1938-1957.

The seven sandy islands of the East Frisian group would appear to be initially formed and now continually supplied with sand from the West Frisian group and the mainland to the west. The inlets between these islands are in dynamic range in the area. Hydrographic information dating back to 1960 permits the development of a hypothetical model which explains the historic changes and might predict future trends. The installation of coastal defense structures on the eroding western extremities of some islands in the mid-19th century has greatly influenced the bars by which sand is transported from island to island in an easterly direction. Under natural conditions (i.e., without protective works) the East Frisian Islands tend to shift eastward. On the basis of well-substantiated long-term events in the Norderney inlet this tendency could be traced back to morphological events in the tidal inlets and systemized in a hypothetical model. The ancient "west-east-migration" or shift of the East Frisian Islands has been effected by the active processes in the tidal inlets, followed passively by the islands. The seawalls and groynes have produced a static condition, which if not present would have been temporary in nature. References (10 items).

Machemehl, J.L., Bird, N.E., and Chambers, A.N. Tidal Inlet Flow Dynamics and Sediment Movement. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1681-1700.

Amein's numerical simulation model for the computation of tidal and freshwater flow exchange through a coastal inlet was modified and calibrated with field data (current, water surface elevation, and bottom topography) for Lockwoods Folly Inlet, North Carolina. The calibrated model was then used to predict the changes in the flow regimes brought about by natural and manmade changes such as storms and dredging, respectively, and to predict the changes in flow regimes caused by the Lockwoods Folly River. A generalized hypothesis of the patterns of sediment through and by-passing the inlet were formulated from an evaluation of the flow data and from an analysis of the orientation and structure of the bedforms observed in the inlet and on the offshore bar. References (2 items).

Mahmood, A., Ehlers, C.J., and Cilweck, B.A. Sand Waves in Lower Cook Inlet, Alaska. (See complete entry in Section VIII.)

Mantz, P.A., and Wakeling, H.L. Aspects of Sediment Movement near to Bridgwater Bar, Bristol Channel. PROCEEDINGS, THE INSTITUTION OF CIVIL ENGINEERS, 73(Pt.2):1-23, March 1982.

The Bridgwater Bar area of the Bristol Channel forms a part of a complex sedimentary environment. It is bordered to the east by sand and mud flats, to the north and west by fast flowing, silt-laden tidal currents, and to the south by a narrow trench which extends to rock outcrops at the coast. A detailed survey has recently been conducted in the southern area as a basis for investigation of the sedimentary processes involved. The new bathymetric data were compared with past data from British Admiralty surveys to gain an idea of historic sediment change. Current monitoring data of the recent survey were analyzed to give a quantitative appraisal of sedimentary bed roughness, and the latter was realistically associated with sedimentary structures of gravel patches, sand waves, tidally aligned flute marks, and silty beds. The current analysis was also used to estimate the peak shear stresses which occur at the sediment bed, and these were confirmed by a tidal level analysis. These shear stress data were then used as a basis for explaining the location of the various bedforms, and investigating the processes of silt transport. References (20 items).

Mason, C. Functional Design of Tidal Entrance Structures for Effective Navigation and Channel Stability. (See complete entry in Section V.)

Mayor-Mora, R.E. Laboratory Investigation of Tidal Inlets on Sandy Coasts. (See complete entry in Section VI.)

Mayor-Mora, R., Mortensen, P., and Fredsoe, J. Sedimentation Studies on the Niger River Delta. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:2151-2169.

An area of the Niger River Delta was studied from October 1974 to October 1975 in connection with feasibility studies and preliminary design for the development of a deep draft

port in the Western portion of the Delta. The provision of a 100-km, 8- or 10-m navigation channel through one of the entrances from the sea, up to new port facilities at Warri required comprehensive hydraulic hydrographic and sedimentation surveys over such period. References (3 items).

McDowell, D.M. Modelling Methods for Unsteady Flows. (See complete entry in Section VI.)

McDowell, D.M. Training Works in Estuaries. (See complete entry in Section V.)

Mehta, A.J., Byrne, R.J., and DeAlteris, J.T. Measurement of Bed Friction in Tidal Inlets. (See complete entry in Section VIII.)

Mehta, A.J., Wechmann, J., and Christensen, B.A. Sediment Management in Coastal Marinas: A Case Study. In: Proceedings, 1981 International Symposium on Urban Hydrology, Hydraulics and Sediment Control, held at the University of Kentucky, Lexington, July 27-30, 1981, 83-90.

Marinas which are inadequately designed against sediment intrusion are common, and Florida, which has in excess of 600 coastal marinas, is no exception. In this paper, the problem of marina sedimentation has been described with special reference to a basin situated near a tidal waterway in Florida. Steps necessary to carry out a comprehensive sediment management program in order to minimize sedimentation have been noted. In the case studied, two sediment sources were identified, namely intrusion from the estuary via the basin entrance and the backfill behind the basin bulkhead. Whereas the first is a settling basin type phenomenon, the second was found to be due to piping. The selected methodology for evaluating a long-term sediment budget for the marina has been described. Computations for redesigning the bulkhead, and a proposed new method involving redesigning the entrance to minimize sedimentation based upon hydrodynamic principles have been summarized. References (16 items).

Milliman, J.D. Sedimentation in the Frasar River and Its Estuary, Southwestern British Columbia (Canada). ESTUARINE AND COASTAL MARINE SCIENCE, 10(6):609-633, June 1980.

The Fraser River, the largest river (in terms of both water and sediment discharge) reaching the west coast of Canada, is a sand-dominated river in which most sediment transport occurs during freshet in late spring and early summer. More than half the sediment discharged during this 2-3 month period is sand. Throughout the rest of the year, the river is characterized by lower flow and low suspended sediment concentrations (primarily silt and clay); net offshore transport during these months is slight, and near-bottom transport appears to be landward. The dominance of sand transport in the Fraser results in an estuarine depositional regime quite different from most mud-dominated rivers and estuaries. Although most sediment in the river is carried in suspension, about 40% of the sand (20% of the total load) settles from suspension in the upper estuary and most of the rest settles prior to reaching the lower estuary. References (18 items).

Muir Wood, A.M., and Fleming, C.A. Coastal Hydraulics, 2d ed. (See complete entry in Section I.)

Munday, J.C., Jr., and Fedosh, M.S. Chesapeake Bay Plume Dynamics from LANDSAT. (See complete entry in Section VIII.)

Nakagawa, H., and Suzuki, K. Local Scour Around Bridge Pier in Tidal Current. COASTAL ENGINEERING IN JAPAN, 19:89-100, 1976.

A big bridge across the Akashi Channel in the Seto Inland Sea where the maximum velocity of tidal current is about 4 m/s is under planning. Two main piers with 40-m × 70-m rectangular cross section are to be erected on the foundation of sand gravel. And, a serious local scour and its protection around the pier are urgent problems to be solved. In order to predict the scour process in prototype, a similarity of scour between a model and its prototype is examined by introducing a reference time when the maximum scour depth becomes the width of the pier. The characteristics of the reference time are investigated by systematic experiments for various scales of sand diameter, flow velocity, and pier width. And, scour depths scale in the case where the scale of sand diameter is distorted from the length scale of the pier is discussed by using a simple assumption. Next, hydraulic model tests to examine the effects of a reverse current and an attack angle are carried out and the characteristics of scour are described. Furthermore, a field test using a steel cylinder with 9-m diameter is done, together with a model test of 1/150 scale, and the similarity of scout phenomenon is discussed on the basis of these results. References (4 items).

Nasner, H. Transport Mechanism in Tidal Dunes. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:2136-2150.

An interesting question, arising within the scope of the further development of the German tidal rivers Elbe and Weser, is whether tidal dunes or sand waves will be formed after the navigation channel deepenings and that the success of the development measures will thus be paritally or fully undone. In order to be able to better assess the formation and regeneration of these large patterns after dredging, heightened knowledge of the sand transport in a tidal dune field is necessary. A possibility of investigating the sand transport in a tidal river with pronounced tidal dunes in the field can be realized by measurings with luminaries or tracers. The advantage of investigations in the field is that all laboratory-required scale effects are eliminated. The more difficult measuring comprehensive of the course of the test in prototype must be solved through purposefully planned investigation programs. References (10 items).

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients; Proceedings of an International Symposium on the Effects of Nutrient Enrichment in Estuaries, Williamsburg, Virginia, 29-31 May 1979. (See complete entry in Section IV.)

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. (See complete entry in Section I.)

Nichols, M., Faas, R., and Thompson, G. Estuarine Fluid Mud: Its Behavior and Accumulation; Final Report. Gloucester Point, Virginia Institute of Marine Science, April 1979.

A study of fluid mud in Virginia estuaries was conducted to determine how the mud accumulates in a dynamic tidal flow regime. The mud occurs as lenses and blanket deposits in zones of fast sedimentation, i.e. on channel floors and in the turbidity maximum zone. Viscosity measurements indicate resuspension potential of the mud is greater in the turbidity maximum than elsewhere. Time-series measurements over a tidal cycle at 6 cm above the bed show that stress increased linearly with acceleration of mean current but lagged maximum current velocity during deceleration of tidal currents. Fluid mud-flow interactions are primarily responsible for accumulation of the mud. References (2 items).

Nummedal, D., et al. Tidal Inlet Variability-Cape Hatteras to Cape Canaveral. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 543-562.

Tidal inlets on the southeast coast of the United States are described in terms of morphological characteristics of the shoals and throat section. A distinct geographic zonation is found to exist: in North Carolina and northern South Carolina the inlets have developed both inner and outer shoals (flood and ebb-tidal deltas). In southern South Carolina and Georgia the tidal inlets have developed large outer shoals, while inner shoals are largely absent. The north Florida inlets resemble those in northern South Carolina. Physical environmental parameters, known to control tidal inlet sedimentation, and system boundary conditions also vary within the same region. These include: tidal range, deep-water wave energy, inner shelf slope, and the percentage of open water in the lagoon. The paper identifies the major mechanisms which control sediment dispersal and deposition at tidal inlets. These are found to favor landward directed transport through the throat in wave-dominated microtidal environments, and seaward transport through the throat in tide-dominated environments. References (21 items).

Officer, C.B. Box Models Revisited. (See complete entry in Section VI.)

Officer, C.B. Discussion of the Turbidity Maximum in Partially Mixed Estuaries. ESTUARINE AND COASTAL MARINE SCIENCE, 10(3):239-246, March 1980.

A set of box model equations is developed to define the suspended sediment distribution and turbidity maximum related to gravitational circulation effects. The box model results are tested against a numerical model simulation of the same problem. References (4 items).

Olsen, E.J. A Study of the Effects of Inlet Stabilization at St. Marys Entrance, Florida. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 311-329.

The stabilization of any naturally functioning inlet by dredging and/or the construction of jetties dramatically modifies the hydraulics of the prior regime, and therefore upsets the long-term "dynamic equilibrium" previously in existence. The consequence is the initiation of a new balance between hydraulic and sedimentary forces which causes a reconfiguration of ocean shoal formations and adjacent shorelines. The paper presents the results of a coastal engineering study evaluating the performance of the Federal navigation project at Fernandina Harbor, Florida, with a view to determining the extent to which the adjacent ocean shores have been affected since commencement of the original project improvements in 1881.

Özsoy, E. Suspended Sediment Transport Near Tidal Inlets. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 914-926.

Jet diffusion and settling of suspended sediments in the vicinity of tidal inlets are analyzed. Bottom friction retards the jet and therefore causes an increase in the deposition rate; however, an offshore sloping bottom opposes this effect. Bottom sediments are sorted with respect to grain size. Large depositions occur where marginal shoals are usually found. For high inlet velocities, erosion near the mouth generates deep troughs due to scouring. These results and their implications on the geomorphology of the inlet vicinity are discussed qualitatively. References (19 items).

Parthiot, F. Development of the River Seine Estuary: Case Study. (See complete entry in Section VI.)

Permanent International Association of Navigation Congresses. Improvement and Maintenance of Navigation Channels and Control of the Regime in Estuaries in Relation to the Energy Due to Tidal Movement, Waves and Swell at the Entrance. (See complete entry in Section V.)

Pinet, P.R., and Morgan, W.P., Jr. Implications of Clay-Provenance Studies in Two Georgia Estuaries. JOURNAL OF SEDIMENTARY PETROLOGY, 49(2):575-580, June 1979.

The amount of kaolinite and illite in bottom muds of Altamaha River and Sound, a partially mixed estuary, does not vary appreciably downstream, indicating that the bulk of the clays is river-supplied. In contrast, much of the bottom mud of Sapelo Sound, a tidal-water body with minor freshwater discharge, seems to be derived from erosion of coastal outcrops. Our results suggest that the clay flux from ocean sources is minimal in either case, and tends to have been overestimated by previous workers. On the other hand, the clay flux from shore erosion tends to have been underestimated in sediment-budget studies of Georgia estuaries. References (32 items).

occurrences and laboratory experiments about stratified free shear flows are often found having different vertical scales of velocity and density. The ratio of the two scales has an effect on the prediction of concentration distribution. The current paper tries to embed these two vertical scales into a density profile of a variable vertical scale proposed by Hazel. This "versatile" density distribution is compared with laboratory measurements. References (3 items).

Ward, G.H., Jr. Hydrography and Circulation Processes of Gulf Estuaries. (See complete entry in Section I.)

West, J.R., and Broyd, T.W. Dispersion Coefficients in Estuaries. THE INSTITUTION OF CIVIL ENGINEERS, PROCEEDINGS, 71(PT.2): 721-737, September 1981.

Estuarine solute transport is caused by a variety of different mechanisms. The relative importance of these is usually dependent on such hydrodynamic factors as tidal range, river flow, channel dimensions, and longitudinal position within the estuary. Many types of engineering work can significantly affect the controlling mechanisms, and hence both the saline intrusion and water quality. Examples of such works are dredging, land reclamation, water abstraction, effluent discharge, hydroelectric schemes, irrigation, and flood prevention. It is therefore important to be able to predict the effect of such works before they are constructed. This paper considers several published relationships for tidally averaged estuarine dispersion coefficients. These are evaluated for a number of British estuaries exhibiting widely differing hydrodynamic conditions. The availability of good quality data allows both comparison of the methods used and generalizations from the cases considered. Expressions for dispersion coefficients where coefficients can be adjusted for specific estuaries have not been considered. The objectives of the paper are twofold: to facilitate the formulation of further empirical and theoretical expressions for dispersion coefficients by adding further evaluations to the literature, and to provide insight into the usefulness and possible errors involved in using some existing expressions for estuarine dispersion coefficients. References (27 items).

West, J.R. and Cotton, A.P. The Measurement of Diffusion Coefficients in the Conwy Estuary. (See complete entry in Section VII.)

Wiegert, R.G. Modeling Salt Marshes and Estuaries: Progress and Problems. (See complete entry in Section VI.)

Yakuwa, I., Takahashi, S., and Ol[illegible]i, M. Salt Water Intrusion into the Mouth of the Teshio River. COASTAL ENGINEERING IN JAPAN, 19:133-138, 1976.

The longitudinal profile of salt wedge and salinity distribution were observed at the mouth of the Teshio River and in the Sarobetsu River, a branch of the Teshio River, on September 26, 1973. According to the results, diffusion of salt water into fresh water was largely influenced by change of the river discharge and the longitudinal profile of the riverbed. The critical discharge of intrusion of salt wedge was obtained as 350 m^3/s and 120 m^3/s for the Teshio River and the Sarobetsu River, respectively. References (2 items).

Yanagi, T. Vertical Residual Flow in Kasado Bay. (See complete entry in Section I.)

Yoshida, S., and Kashiwamura, M. Tidal Response of Two-Layered Flow at a River Mouth. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3189-3207.

The paper describes various features of tidal effects on the behavior of a salt wedge and on the mechanism of mixing between the salt water and the fresh water in the vicinity of a river mouth. The studies have been performed through experiments, field observations, and theoretical considerations. The condition upon which the fresh water begins to show an intermittent flow pattern owing to an increase of the tidal action, and the criterion of a transition of the mixing type from negligible into intense, were obtained, with two dimensionless parameters λ and θ. The former parameter λ is given by λ equals A_0/U_0T_0, in which T_0 is the tidal period, A_0 is the tidal amplitude of the sea level, and U_0 is the temporal mean velocity of the fresh water at the river mouth. The latter parameter is the so-called Keulegan number. Besides, it became evident that a tidal motion of the salt wedge could not be understood without a consideration of the internal wave inside the mouth, which was induced by the tide, in addition to a direct effect of the tide. References (7 items).

is uniform and constant along the interface. A new type of formula for the interfacial friction coefficient is proposed based on the theoretical result on viscous dissipation in the boundary layer along the interface. The interfacial friction coefficient is supposed to be inversely proportional to the square root of the product of the Reynolds number of a moving layer and the densimetric Froude number to the fifth. The new formula agrees with observed data better than the best empirical law does especially in the range of the large Reynolds number. It is found out, however, that the proportional constant may be affected by stability of the two-layered flow system concerned. References (7 items).

Taylor, R.B. Dispersive Transport in River and Tidal Flows. (See complete entry in Section I.)

Thakar, V.S., and Bhandary, R.S. Two-Dimensional Mathematical Model of Circulation in Bombay Harbour. (See complete entry in Section VI.)

Trawle, M.J. Georgetown Harbor, South Carolina, Report No. 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. (See complete entry in Section VI.)

Ueshima, H., Fujiwara, T., and Hayakawa, N. Salt Transport Mechanism in Tidal Waters. COASTAL ENGINEERING IN JAPAN, 19:121-132, 1976.

Observations of tide level, velocity, and salinity at seven sections over 8 km reach of the estuary of Yoshii river are reported herein. Data together with Tomoe river data and the mouth of Tokyo Bay data are analyzed in order to elucidate the mass transport mechanism in estuaries. Attention is focused in this paper on the cases with large ratios of tidal range to average depth. Terms contributing to the mass transport directly related to fluctuation of cross-sectional area are evaluated and found to be of small magnitude even if the tidal range is of comparable order to the mean depth. Among terms of mass transport the phase difference effect of cross-sectional averages of velocity and salinity is found to be significant, if not dominant, compared with the shear effect and net riverflow effect. For partially stratified estuaries the net transverse circulation term predominates over shear effect terms. For homogeneous estuaries the net vertical circulation term is dominant over other terms. References (9 items).

Vollmers, H. Harbour Inlets on Tidal Estuaries. (See complete entry in Section II.)

Waldrop, W.R., and Farmer, R.C. A Computer Simulation of Density Currents in a Flowing Stream. In: Proceedings, International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle-Upon-Tyne, England, April 12-15, 1976, C3-29-C3-37.

Counterflow resulting fron density differences in a flowing stream is discussed and results of a computer simulation of an unsteady flow are presented. The difference in density may result from either salinity or temperature differences. Vertical and longitudinal variations of density and velocity are computed by solving finite difference approximations of the unsteady two-dimensional Navier-Stokes equations. The use of the third spatial dimension is unnecessary to describe the physical phenomena governing the upstream flow. The effect of turbulence is included by using a mixing length theory. The retarding effect of stratification upon vertical mixing was included by dampening the vertical eddy coefficients as a function of the local Richardson number. The boundary conditions include the upstream flow rate, and the surface height at the upstream and downstream boundaries. These conditions may be varied as a function of time to study the effects of such parameters as tide and river stage. In the example presented, the migration of saltwater intrusion into a flowing stream during a diurnal tidal cycle is shown as a series of velocity vectors, isohalines, and free surface heights. The slope of the streambed is arbitrary so long as it varies smoothly between grid rows. References (9 items).

Wang, D.-P. Observation and Modeling of the Circulation in the Chesapeake Bay. (See complete entry in Section VI.)

Wang, D.-P. Wind-Driven Circulation in the Chesapeake Bay, Winter 1975. (See complete entry in Section I.)

Wang, J.D. Finite Element Model of 2-D Stratified Flow. (See complete entry in Section VI.)

Wang, Y.H. Determination of Interfacial Eddy Diffusion Coefficient of Highly Stratified Estuary. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976. Honolulu, Hawaii, IV:3158-3168.

In highly stratified estuaries (salt wedges) a distinct interface or interfacial layer exists which separates the two nearly homogeneous layers. The vertical advection of salt in this two-layer flow is the dominant process in maintaining the salt balance. This paper presents an analytical model describing this process. Experiments have been conducted in the laboratory to compare with the developed theory. References (9 items).

Wang, Yu-Hwa. Salinity Distribution of a Highly Stratified Estuary. In: Proceedings, 25th Annual Hydraulics Division Specialty Conference on Hydraulics in the Coastal Zone, New York, ASCE, 1977, 130-135.

A highly stratified estuary may be described as two superimposed streams of different densities (fresh and salt waters) and velocities. There are two types of problems that are often of interest: (1) to calculate the density distribution across the interfacial region for given flow conditions, and (2) to determine the interfacial stability for given density and velocity distributions. The first problem involves solving the equations of motion and diffusion equations simultaneously. The second problem deals with the solution of the Taylor-Goldstein equation with proper boundary conditions. It is desirable for both problems that an expression of the density profile with variable scales be devised. Natural

an estuary cross section. Three hypotheses on the nature of the distribution are used to test the designs. The procedures are applied to Southampton Water where it is found that although both the salinity and velocity have important transverse and vertical variations, the longitudinal advective salt flux is almost totally due to their vertical deviations. This result, which contrasts with previous analyses, follows from the effect of gravity in vertically stratifying both the salinity and velocity distributions. References (16 items).

Roelfzema, A. Effect of Harbours on Salt Intrusion in Estuaries. Delft Hydraulics Laboratory, Publication No. 204, October 1978.

A harbor, connected to a tidal river, will affect the salt intrusion in the river. To study the interaction between harbor and river a systematic investigation has been carried out in the tidal salinity flume of the Delft Hydraulics Laboratory. The investigation included measurements of the density distribution in the harbor and river and measurement of the exchange phenomena in the harbor entrance. The study was executed as part of a long-term basic research program on salt intrusion in tidal rivers, commissioned to the Delft Hydraulics Laboratory by the Rijkswaterstaat (Dutch Government Public Works Department). References (11 items).

Ruzecki, E.P. Temporal and Spatial Variations of the Chesapeake Bay Plume. (See complete entry in Section VIII.)

Schmidt, G.M. The Exchange of Water Between Prince William Sound and the Gulf of Alaska. (See complete entry in Section I.)

Schroeder, W.W. Dispersion and Impact of Mobile River System Waters in Mobile Bay, Alabama. (See complete entry in Section VIII.)

Sea Grant Publications Index 1979. (See completed entry in Section I.)

Severn Tidal Power. (See complete entry in Section V.)

Sholkovitz, E.R. Chemical and Physical Processes Controlling the Chemical Composition of Suspended Material in the River Tay Estuary. (See complete entry in Section II.)

Show, I.T., Jr. The Movements of a Marine Copepod in a Tidal Lagoon. (See complete entry in Section VI.)

Smith, T.J., and Takhar, H.S. A Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation. (See complete entry in Section VI.)

Stevenson, L.H., Chrzanowski, T.H., and Kjerfve, B. Short-term Fluxes Through Major Outlets of the North Inlet Marsh in Terms of Adenosine 5'-Triphosphate[a]. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K.B. Macdonald, New York, Plenum Press, 1980, 355-369.

Transects across three major creeks joining the North Inlet marsh system to the neighboring ocean and bay environments were characterized in terms of the temporal fluctuations, distribution, and short-term transport of total microbial biomass (measured as adenosine 5'-triphosphate ATP). The mean ATP density ranged from 0.865 to 1.357 mg/m^3. Highest densities were recovered during flood tides. The distribution of mean ATP densities as well as net flux through each interface proved to be complex with both vertical and horizontal stratification apparent at some locations. A net import of ATP at a rate of about 40 mg/s was noted at the two creeks that interfaced directly with the oceanic environment. A net export was noted through the creek that emptied into the bay. The results indicate that the characterization of a tidal creek interface in terms of ATP, or similar parameters, requires the simultaneous measurement of both the component of interest and directional velocity. References (15 items).

Suga, K. Unsteady, Stratified Flow with Entrainment by Tides. In: Proceedings, Seventeenth Congress of the International Association for Hydraulic Research, Hydraulic Engineering for Improved Water Management, Baden-Baden, Federal Republic of Germany, August 15-19, 1977. Hydraulic Fundamentals of Mathematical and Physical Modelling, IAHR, Paper A37, 1977, 9(Subj.A):287-294.

Saline water intrusion into rivers in the state of weak to moderate mixing conditions was considered mainly from the practical point of view. Nowadays, not only the qualitative characteristic of the phenomena, but also the quantitative movements of saline water intrusion in an estuary are requested to be estimated at the same time when some works are proposed. Main disputes in the field phenomena are considered to be the estimation of mixing effects and their modelling. Therefore, field and experimental data are collected to analyze the general aspects of the mixing states by tides. A one-dimensional, unsteady, two-layer flow model in an estuary was considered, with the existence of entrainment of saline water of longitudinal changing density from the lower layer to the upper layer. Internal friction factor and entrainment constants were determined by field and experimental data. Saline water intrusion of unsteady condition in a weak mixing state was proved to be fairly well estimated by the model. Moderate mixing and three-dimensional problems were also investigated. References (9 items).

Svendsen, H., and Thompson, R. Wind-Driven Circulation in a Fjord. (See complete entry in Section I.)

Tamai, N. Friction at the Interface of Two-Layered Flows. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3169-3207.

Viscous perturbed velocity field induced by interfacial waves is solved to the first order in terms of wave amplitude for sharply stratified flows described in a curvilinear coordinate system assuming that the external velocity

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients. (See complete entry in Section IV.)

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. (See complete entry in Section I.)

Nihoul, J.C.J., Runfola, Y., and Roisin, B. Shear Effect Dispersion in a Shallow Tidal Sea. (See complete entry in Section I.)

Nixon, S.W. Between Coastal Marshes and Coastal Waters--A Review of Twenty Years of Speculation and Research on the Role of Salt Marshes in Estuarine Productivity and Water Chemistry. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K.B. Macdonald, New York, Plenum Press, 1980, 437-525.

There is a growing awareness of and frustration with the complexity of marsh-estuarine interactions. This complexity is real, but a great many studies have been carried out recently, and it cannot help but be useful to bring some of their results together. The evolution of the idea of organic export and its extension to the fluxes of nutrients, metals, and other substances between salt marshes and estuaries is also worth exploring. It has been one of the prevailing interests of marine ecology during the past 20 years, and it reflects much of what is best and worst in ecological research. It has also led to some of the most controversial applications of ecological research to problems of coastal zone management and political decision making. The literature dealing with marsh-estuarine interactions is large and this review concentrates almost exclusively on questions of the exchange of carbon, nitrogen, and phophorus, with some attention to sediments and a few of the trace metals. It does not deal with animal migrations, fluxes of larvae, a host of exotic chemicals, or a number of other possible problems. References (151 items).

O'Connor, B.A., and Thompson, G. A Mathematical Model of Chloride Levels in the Wear Estuary (UK). (See complete entry in Section VI.)

Officer, C.B. Box Models Revisited. (See complete entry in Section VI.)

Posmentier, E.S., and Raymont, J.M. Variations of Longitudinal Diffusivity in the Hudson Estuary. (See complete entry in Section I.)

Pratte, B.D. Churchill River Salt Water Tidal Model. (See complete entry in Section VI.)

Priessmann, A. Use of Mathematical Models. (See complete entry in Section VI.)

Qasim, S.Z., and Gupta, R.S. Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa. ESTUARINE, COASTAL AND SHELF SCIENCE, 13(5):557-578, November 1981.

Two rivers, the Mandovi and the Zuari, with their interconnecting canal, form an estuarine system in Goa on the west coast of India. Physical, chemical, and biological features of this estuary are adapted to a seasonal rhythm induced by the annual cycle of the monsoon. Heavy precipitation and land runoff from June to September bring about large changes in temperature, salinity, flow pattern, dissolved oxygen, and nutrients when the estuary becomes freshwater dominated. The monsoon season (July-September) is followed by a recovery period during the postmonsoon season (October-January) and thereafter a stable period of the premonsoon season (February-May) when the estuary becomes marine dominated. During the premonsoon (dry) season, the water in the estuarine system remains well mixed and the intrusion of salt water is felt as far as 65 km upstream in both the rivers; but during the monsoon season the rivers become stratified and a salt wedge is formed in each river which extends up to about 10 km upstream in the Mandovi and 12 km in the Zuari. The flow of the estuarine system is regulated by the entry of seawater with the incoming tide through Zuari which reaches Mandovi through the canal. The flow is reversed during the outgoing tide when the estuarine system is flushed. Dilution factors in both the estuaries are similar and vary from 1.2 to 8; highest values occur during the premonsoon season. Two shoals/sand bars occur permanently in Mandovi (Aguada Bay) close to a ramplike inlet to the sea. This inlet poses no navigational problems for about 9 months during the dry season; but for a 3-month period during the monsoon, the waterway becomes hazardous and is closed to boat traffic. Heavy swell and intense wave activity lead to the transfer of sediments into the navigational inlet and the calm season brings the materials back to their original position with practically no overall change in the bathymetry of the bay. The oxygen cycle in the estuarine system is closely related to seasonal changes in temperature and bears an inverse relationship with salinity. In both the estuaries, the sulphate/chlorinity relationship remains uniform and similar to that of the sea except during the monsoon months when the relationship gets disturbed. Changes in phosphorus, nitrogen, and silicon are largely regulated by rainfall and land runoff. There is no significant difference in the phytoplankton counts between Mandovi and Zuari which follow a rhythm similar to that of nitrate. Zooplankton biomass is higher in Zuari because of its greater marine influence. No seasonal variation was observed in the density of microflora in the two rivers. Bacterial counts were higher in the lower reaches of the estuarine system and decreased upstream. From its environmental features, the estuarine system can be classified as a tide-dominated coastal plain estuary. References (33 items).

Rattray, M., Jr., and Dworski, J.G. Comparison of Methods for Analysis of the Transverse and Vertical Circulation Contributions to the Longitudinal Advective Salt Flux in Estuaries. ESTUARINE AND COASTAL MARINE SCIENCE, 11(5): 515-536, November 1980.

Three different sampling designs, based upon the manner in which the total cross-sectional area is decomposed into subareas, are explored for their applicability to assessing the transverse and vertical variations of properties in

surface salinity during the Chesapeake Bay plume studies. Obtained measurements of microwave brightness temperatures of the sea surface were combined with measurements of sea surface temperature obtained with an infrared radiometer and inverted to produce corresponding values of sea surface salinity. Results from the plume measurements, which indicate the southward extent of the plume along the Virginia-North Carolina coast, are presented and discussed. Additional measurements obtained for the Delaware Bay Mouth flight, and the James River-Shelf flight, are also discussed. References (2 items).

Kinsman, B., et al. Transport Processes in Estuaries: Recommendations for Research; Final Report. (See complete entry in Section II.)

Kjeldsen, S.P. Algorithm for Vertical Diffusion. (See complete entry in Section VI.)

Krause, G. Grundlagen zur Trendermittlung des Salzgehalts in Tide-Aestuarien (Fundamentals of Trend Analysis of Salinity in a Tidal Estuary). DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 32(6):233-247, November 1979. (In German.)

A yearly time series of hourly salinities measured in the Weser estuary, Federal Republic of Germany, is considered from the viewpoint of a long-term observer who wants to investigate the trend of salinity as a result of human activities in the area, such as dredging or engineering constructions. It is necessary to eliminate climatic fluctuations caused by variable river discharge, and salinity variability as a result of external forcing mechanisms like wind set-up, surges, shelf waves, and seiching. On time scales larger than diurnal tidal constituents the sum of all complicated mixing processes associated with the tides can be considered as turbulent fluctuations or noise. Filtered data of salinity and water level show very good coherence, the phase shift is zero, and there is a linear relationship between salinity and water level fluctuations, indicating that a simple mixing equation holds for the time scale of interest, and confirming the assumption of tides to be regarded as noise. Salinity fluctuations can be computed from the filtered water level which is used to arrive at a salinity series free from externally generated events. The reduced salinity series is then examined together with the river discharge based on the principle of a constant salinity flux. The concept of a river discharge-salinity diagram is introduced. References (14 items).

Krause, G. Physical Processes in Tidal Estuaries in Relation to the Monitoring of Water Quality. OCEAN MANAGEMENT, 6(4):229-314, May 1981.

Long-term trends of water quality as a result of human activities in estuaries represent a very weak signal which is masked by processes originating from the adjacent sea area and by climatological fluctuations in the catchment area. Using salinity as a basic variable, methods are described by which this weak signal can be recovered, and the kinds of observation required for this purpose. It is shown that the physical state of an estuary can be described in terms of filtered water level, filtered salinity, and river discharge which describe the mixing of river and sea water on longer time scales. In the well-mixed Weser estuary in Germany, the lower limit of this scale is only on the order of 2 to 3 tidal cycles. Beyond this limit, the simple equation for complete mixing allows for the calculation of the externally generated variability of salinity as a result of large-scale weather patterns over the North Sea and North Atlantic, and a simple salt flux model accounts for fluctuations of the river discharge. Based on the results of salinity, assessment of trends of water quality is possible, including the numerous variables which can only seldom be measured due to difficult, time-consuming, and costly sampling and analysis procedures. Conclusions are also drawn with respect to calibration of numerical tidal models. References (9 items).

Kristof, R.C. The Role of Physical Modeling in the Mathematical Modeling of the Sacramento-San Joaquin Delta. (See complete entry in Section VI.)

Larsen, L.H. Dispersion of Passive Contaminant in Oscillatory Fluid Flows. JOURNAL OF PHYSICAL OCEANOGRAPHY, 7(6):928-931, November 1977.

The author considers dispersion in an oscillatory boundary layer in an effort to ascertain the relative importance of velocity shear and phase. Although salt is not strictly a passive contaminant, the model considered is relevant to the induced transport of salt in a tidal estuary. The results indicate a transport directed toward higher concentrations near a boundary whenever the velocity phase near that boundary leads the interior flow. References (6 items).

Leendertse, J.J., and Lui, S.K. Three-Dimensional Flow Simulation in Estuaries. (See complete entry in Section VI.)

Lewis, R.E. Transverse Velocity and Salinity Variations in the Tees Estuary. (See complete entry in Section I.)

Liu, S.-K., and Leendertse, J.J. A Three-Dimensional Model for Estuaries and Coastal Seas: Volume VI, Bristol Bay Simulations. (See complete entry in Section VI.)

Liu, S.-K., and Leendertse, J.J. Multidimensional Numerical Modeling of Estuaries and Coastal Seas. (See complete entry in Section VI.)

McDowell, D.M. Salinity Intrusion in Estuaries. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 3, 1973.

The intrusion of saline water into an estuary from the viewpoint of displacement of saline water seawards by fresh water is discussed. Three specific concepts: conservation of mass; the dynamic processes involved; and saline intrusion as an arrested saline wedge are presented. References (12 items).

Najarian, T.O., Thatcher, M.L., and Harleman, D.R.F. C & D Canal Effect on Salinity of Delaware Estuary. (See complete entry in Section V.)

independent of the flow Reynolds number upstream of a salt wedge and can be scaled to give a stability parameter for prototype flows. Measurements of the rate of mixing at the interface proved that mixing theory based on momentum exchange of turbulent flows is valid as a working hypothesis, and that this mixing is inversely proportional to the relative density. References (18 items).

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. (See complete entry in Section I.)

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. (See complete entry in Section I.)

Hargis, W.J., Jr. A Benchmark Multi-Disciplinary Study of the Interaction Between the Chesapeake Bay and Adjacent Waters of the Virginian Sea. In: NASA Langley Research Center Chesapeake Bay Plume Study, Virginia Institute of Marine Science, Gloucester Point, October 1981, 1-4.

The social and economic importance of estuaries is discussed. Major focus is on the Chesapeake Bay and its interaction with the adjacent waters of the Virginia Sea. Associated multiple use development and management problems as well as their internal physical, geological, chemical, and biological complexities are described. References (12 items).

Harleman, D.R.F. Salinity Intrusion and Dispersion. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 10, 1973.

Salinity circulation and mixing in estuaries as physical processes are discussed. Emphasis is placed on laterally homogeneous estuaries, such as the Delaware and the Hudson estuaries, in which the salinity circulation generally is in the vertical and longitudinal directions. References (12 items).

Harriss, R.C., Ribelin, B.W., and Dreyer, C. Sources and Variability of Suspended Particulates and Organic Carbon in a Salt Marsh Estuary. (See complete entry in Section II.)

Holloway, P.E. Longitudinal Mixing in the Upper Reaches of the Bay of Fundy. ESTUARINE, COASTAL AND SHELF SCIENCE, 13(5): 495-515, November 1981.

A time-dependent, one-dimensional, advection-diffusion equation is used to predict the salinity distribution in the vertically well mixed upper regions of the Bay of Fundy. It is shown that the longitudinal diffusion coefficient must increase in a seaward direction from the head of the bay to give a good agreement between the model and observations, and a simple parameterization of the coefficient is sought in terms of the product of appropriate length and velocity scales. A coefficient equal to $b_1U_0l_0$, where b_1 is a constant, U_0 the amplitude of the tidal current, and l_0 the tidal excursion, is tried but does not give this increase and produces a poor description of the salinity distribution. However, a diffusion coefficient of the form $c\bar{u}_*\bar{h}$, where c is a constant, u_* the r.m.s. friction velocity from the tidal current averaged over the M_2 tide, h is the water depth and the overbar denotes a cross-sectional average, does give the required increasing value and allows a good agreement between the model and observations for $c = 200$. This form of parameterization is the same as that for shear dispersion except that the coefficient c is in order of magnitude too large. It is suggested, instead, that the diffusion process results from the interaction of tidal residual eddies with the oscillatory tidal flow, a mechanism described by Zimmerman (1976) and capable of producing large diffusion coefficients. Preliminary estimates show that the construction of a tidal power barrage across Minas Basin would considerably reduce the salinity in the headpond of the barrage but have little effect seaward. A sinusoidally varying freshwater input to the estuary is shown to have a significant effect on the salinity distribution only for periods of oscillation exceeding a month, while variations in the longitudinal diffusion coefficient due to an apogee-perigee tidal cycle have little effect on the salinity distribution. References (25 items).

Hudson, R.Y., et al. Coastal Hydraulic Models. (See complete entry in Section VI.)

Huyer, A., and Smith, R.L. Physical Characteristics of Pacific Northwestern Coastal Waters. (See complete entry in Section I.)

Imberger, J. Dynamics of a Longitudinally Stratified Estuary. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3108-3123.

A partially stratified estuary is defined as one which possesses a quite definite longitudinal salinity gradient from the mouth to the head of the estuary, but only a very weak vertical or transverse salinity structure. For an estuary to exhibit such characteristics it must possess a source of fresh water near the head of the estuary, sufficient vertical mixing to overcome the potential energy associated with such a freshwater inflow, and be very much longer than its width to reduce transverse variations. If the estuary is very shallow (a few meters) then wind generated turbulence is often sufficient to eliminate most or all the vertical structure. Deeper, or very sheltered, estuaries require additional strong tidal shears to break up the vertical density gradients. However, in both cases the mixing is usually not sufficient to completely homogenize the estuary longitudinally and it is found that these estuaries display a near linear salinity gradient along the principal axis of the estuary throughout most of the spring and summer months. References (6 items).

Kendall, B.M. Remote Sensing of the Chesapeake Bay Plume Salinity via Microwave Radiometry. In: Chesapeake Bay Plume Study, National Aeronautics and Space Administration, Langley Research Center, Hampton, Va., October 1981, 131-140.

The NASA-Langley-developed L-Band microwave radiometer was used to remotely measure sea

Campbell, J.W., Esaias, W.E., and Hypes, W.D. SUPERFLUX I, II, and III Experiment Design: Remote Sensing Aspects. (See complete entry in Section VII.)

Chapman, P.M. Measurements of the Short-Term Stability of Interstitial Salinities in Subtidal Estuarine Sediments. ESTUARINE, COASTAL AND SHELF SCIENCE, 12(1):67-81, January 1981.

Diurnal comparisons of sediment interstitial salinities with those of the immediately overlying water were conducted subtidally at five stations in the Fraser River estuary, B.C. These in situ studies indicated that the interstitial salinities of sediments containing a high proportion of silt were relatively constant despite large fluctuations in water column salinities; however, in sands, interstitial salinities closely followed diurnal salinity variations in the water column. Laboratory penetration studies were conducted using relatively undisturbed natural sediments. The results of the in situ and laboratory studies indicated that exchange between the interstitial and overlay water was influenced by three major factors: the rate of water flow above the sediment, the relative salinities of the interstitial and overlying water, and the sediment composition. References (24 items).

Chu, W-S., and Yeh, W.W-G. Two-Dimensional Tidally Averaged Estuarine Model. (See complete entry in Section VI.)

Cooke, J.C. Dispersal of Microfungi in the Thames River Estuary of Eastern Long Island Sound. (See complete entry in Section VII.)

Daly, M.A., and Mathieson, A.C. Nutrient Fluxes Within a Small North Temperate Salt Marsh. (See complete entry in Section IV.)

Davies, J.L. Geographical Variation in Coastal Development, edited by K.M. Clayton. (See complete entry in Section II.)

De Grandpre, C.D.B., El-Sabh, M.I., and Salamon, J.C. A Two-Dimensional Numerical Model of the Vertical Circulation of Tides in the St. Lawrence Estuary. (See complete entry in Section VI.)

Doyle, B.E., and Wilson, R.E. Lateral Dynamic Balance in the Sandy Hook to Rockaway Point Transect. (See complete entry in Section I.)

Dronkers, J.J. Some Practical Aspects of Tidal Computations. (See complete entry in Section VI.)

Eaton, A. Removal of 'Soluble' Iron in the Potomac River Estuary. (See complete entry in Section IV.)

Edinger, J.E., and Buchak, E.M. Numerical Hydrodynamics of Estuaries. (See complete entry in Section VI.)

Farmer, D.M., and Smith, J.D. Tidal Interaction of Stratified Flow with a Sill in Knight Inlet. (See complete entry in Section I.)

Fischer, H.B., ed. Transport Models for Inland and Coastal Waters. (See complete entry in Section VI.)

Fischer, K. Numerical Model for Density Currents in Estuaries. (See complete entry in Section VI.)

Frenet-Robin, M., and Ottmann, F. Comparative Study of the Fixation of Inorganic Mercury on the Principal Clay Minerals and the Sediments of the Loire Estuary. (See complete entry in Section II.)

Giese, G.L., Wilder, H.B., and Parker, G.G., Jr. Hydrology of Major Estuaries and Sounds of North Carolina. (See complete entry in Section IV.)

Godfrey, J.S. A Numerical Model of the James River Estuary, Virginia, U.S.A. (See complete entry in Section VI.)

Gordon, R.B., and Spaulding, M.L. A Nested Numerical Tidal Model of the Southern New England Bight. (See complete entry in Section VI.)

Gordon, R.B., and Spaulding, M.L. A Three Dimensional Numerical Model of Estuarine Circulation. (See complete entry in Section VI.)

Graf, W.H. Hydraulics of Sediment Transport. (See complete entry in Section II.)

Grubert, J.P. Estuarine Front Formation and Propagation. Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY6):961-975, June 1980.

Front conditions associated with estuarine saline wedges are investigated both theoretically and experimentally. It is deduced theoretically that two distinct front types should exist in a salt wedge estuary, namely wave fronts and St. Venant fronts. When the salt wedge is advancing in its ambient fluid on the flood tide a wave front exists characterized by a vertical wall of water. On the ebb flow however, when the salt wedge is retreating in its ambient fluid, a St. Venant front should occur characterized by zero depth at the front. Experiments confirmed that these two front types do occur, but due to stability constraints, their frontal flow conditions are different from that predicted by theory. It is deduced that the fronts of all salt wedges effectively end at the critical flow section and that this should be the front criterion upon which a mathematical model of a salt wedge estuary is based. References (15 items).

Grubert, J.P. Experiments on Arrested Saline Wedge. Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY6):945-960, June 1980.

Experimental results are presented which show that the onset of interfacial wave breaking can be expressed by a stability parameter which is a function of the interfacial densimetric Froude number and the interfacial Reynolds number. This parameter is shown to be

Anwar, H.O., and Weller, J.A. An Experimental Study of the Structure of a Fresh-Saltwater Interfacial Mixing. LA HOUILLE BLANCHE, 36(6):405-412, 1981.

This paper describes the results of an experimental study of fresh water which flows two-dimensionally over a still pool of salt water. This type of flow can be observed when heated cooling water is discharged from a power station horizontally onto the surface of a lake, reservoir, or in an estuary where the outflow of freshwater mixes with underlying salt water; the flux of brackish water increases with the distance downstream from the head of the estuary. The object of the investigation is to study the cases in which the densimetric Froude number is low, varying between 0.5 and 2 and, the depths of fresh water, which are relatively large, vary between 0.08 m and 0.12 m. It is assumed that the flow structure and the turbulent mixing process that occur in this study are similar to those occurring in nature. References (37 items).

April, G.C. and Raney, D.C. Predicting the Effects of Storm Surges and Abnormal River Flow on Flooding and Water Movement in Mobile Bay, Alabama. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 217-245.

The paper discusses the recent numerical modeling activities of the Mobile Bay system under severe conditions. Results are presented in terms of changes that occur in water elevation and movement, and in salinity distribution patterns when the bay is subjected to river flooding inflows and storm surges. At a river flood state of 7,000 m^3/s, water behavior in the northern and central portions of the bay is totally governed by the freshwater inflow. A salinity level of 5 ppt is restricted to the lower bay at a point 15 km from the Main Pass. Usual salinity values under normal conditions are in the range of 15 to 20 ppt in this area. A critical river flow rate of 8,500 m^3/s is also identified. At or above this flow, saline water intrusion in the lower bay becomes stabilized at 10 ppt on a line 6 km north of the Main Pass. Conversely, large amounts of saline water enter the bay under storm surge conditions investigated in this study. Conditions typical of those caused by Hurricane Camille in 1969 were used in the modeling exercise. Salinity levels as high as 26 ppt were predicted for the northern bay area. This high saline water intrusion is caused by the development of the surge hydrograph at the gulf/bay interface as the storm approaches the coastline. In both cases the model results were shown to be representative of bay behavior. Comparisons with existing field observations were made to calibrate and verify the models. References (9 items).

Bale, A.J., and Morris, A.W. Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries. (See complete entry in Section IV.)

Bastian, D.F. Salinity Effects of Deepening the Dredged Channels in the Chesapeake Bay. Paper Presented at The World Dredging Conference (9th), 29-31 October, 1980, Springfield, Va., December 1980. 15p.

Recent tests on the Chesapeake Bay Model, the world's largest estuarine model, were used to assess the effects of increasing the approach channels to Baltimore from 13 m to 15 m. There are four sections of dredged channels comprising 55 km of the 277-km distance from the bay mouth to Baltimore. The increased depth of channel would extend the length of dredged channels to 79 km. First, base tests using the existing 13-m channels were conducted to determine the synoptic velocity, salinity, and tidal conditions at a number of locations throughout the bay but primarily in the dredged channels. To give meaningful results, a 2-1/2-year hydrographic period was simulated in the model to enhance the evaluation by adding the variable discharge as a parameter. Furthermore, a 12-constituent harmonic tide was used given a 28-lunar-day tidal sequence which simulating a lunar month was repeated throughout the test. The entire test was repeated but with the 15-m channel installed. The primary result from the test is the comparison by location of the changes from base to plan of the salinity time histories which vividly show the effects of geometry, tidal, and discharge changes.

Berger, R.C., Jr., and Boland, R.A., Jr. Mobile Bay Model Study, Report 2, Effects of Enlarged Navigation Channel on Tides, Currents, Salinities, and Dye Dispersion, Mobile Bay, Alabama; Hydraulic Model Investigation. (See complete entry in Section VI.)

Bertram, C.L., and Shore, R.A. Remote Identification of a Salt Water Wedge Through Dissipative Media with a Monocycle Radar. (See complete entry in Section VII.)

Blanton, J.O. The Transport of Freshwater off a Multi-Inlet Coastline. (See complete entry in Section I.)

Boicourt, W.C. Circulation in the Chesapeake Bay Entrance Region: Estuary-Shelf Interaction. (See complete entry in Section VII.)

Bonnefille, R. Present State of Knowledge: The Physical Behaviour of an Estuary and Its Implication on Estuary Dynamics. (See complete entry in Section I.)

Booda, L. Ocean Energy Challenges Technology; Grows. (See complete entry in Section V.)

Bowden, K.F. Turbulent Mixing in Estuaries. (See complete entry in Section I.)

Breusers, N.C., and Van Os, A.G. Physical modeling of Rotterdamse Waterweg Estuary. (See complete entry in Section VI.)

Brogdon, N.J., Jr. Mayport-Mill Cove Model Study, Report 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. (See complete entry in Section VI.)

SECTION III. SALINITY EFFECTS

Saltwater intrusion, locks separating bodies of fresh and salt water, salinity currents, saltwater barriers, and contamination by salt water as distinguished from contamination from other sources.

completely flushed from the lower reaches of the channel and significant quantities of sandy bed load and suspended silts are debouched into the Tasman Sea. However, breaking waves cause intense mixing between the effluent and ambient waters while wave-induced mass transport and setup oppose and partially impound outflow. Sediments accumulate as a river mouth bar and postdepositional shoreward returning of sands by shoaling waves produces a constricted outlet. During low river stage, wave setup enhances flood tidal currents and partially inhibits ebb tide outflow. This leads to a gradual shoreward migration of the river-mouth bar, a narrowing of the constricted outlet, and to upstream migration of river-mouth sands into the lower reaches of the channel. References (9 items).

Wright, L.D., Thom, B.G., and Higgins, R.J. Wave Influences on River-Mouth Depositional Process: Examples from Australia and Papua New Guinea. ESTUARINE AND COASTAL MARINE SCIENCE, 11(3):263-277, September 1980.

Field observations of river-mouth effluent dynamics and resulting patterns of sediment transport have been replicated in and seawards of the mouths of the Shoalhaven River (New South Wales, Australia) and Jaba River (Bougainville, Papua New Guinea). The mouths of both rivers are strongly influenced by wave processes. At both river mouths, breaking waves cause intense mixing between river and seawaters while wave-induced momentum flux and setup oppose outflow. Rapid deceleration and lateral expansion result, creating broad crescent-shaped bars near the outlets. Subaqueous levees assume the form of broad shoals surmounted by shoreward-migrating swash bars. River water with high suspended load remains trapped by waves along the beach on either side of the river mouths. In the case of the Jaba, fines accumulate in the trough and wave reworking of bar sands leads to a succession of low beach ridges separated by mud-filled swales. The seaward-protruding accumulations at both river mouths cause wide, dissipative surf zones and pronounced shore-normal and shore-parallel gradients in radiation stress and setup. This results in a flow of water away from the locus of maximum deposition toward adjacent regions of lower setup; flow then turns seaward as large-scale rips. The rips create pronounced delta-margin erosion and result in arcuate embayments flanking the river-mouth bulge. Under low stage conditions the low-gradient lower course of the Shoalhaven behaves as a partially mixed estuary. Breaking waves enhance flood-tide currents and inhibit ebb currents. Bar sands migrate shoreward and enter the estuary producing an elongate shore-normal sand body in the form of channel fill and estuarine shoals. References (24 items).

Yalin, M.S. Origin of Submarine Dunes. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:2127-2135.

The turbulent bursting process is outlined and attention is drawn to the fact that the coherence distance of the regenerating macro-turbulent eddies is of a magnitude that is much the same as the length of dunes. Consequently it is postulated that the length of dunes is merely the "imprint" of the coherence distance on the deformable surface of a movable bed and the origin of dunes is explained accordingly. It is shown that the frequently observed similarity between tidal and unidirectional dunes is due to the similarity of the tidal transport and the transport corresponding to an intermittent unidirectional flow. The explanations presented herein are expected to be valid for dunes caused by both unidirectional flows and tidal currents. References (9 items).

Yanagi, T. Vertical Residual Flow in Kasado Bay. (See complete entry in Section I.)

Zimmerman, J.T.F. Dynamics, Diffusion and Geomorphological Significance of Tidal Residual Eddies. (See complete entry in Section I.)

Wang, D.-P., and Kravitz, D.W. A Semi-Implicit Two-Dimensional Model of Estuarine Circulation. (See complete entry in Section VI.)

Wave and Tidal Energy. (See complete entry in Section VI).

Wells, J.T., and Coleman, J.M. Physical Processes and Fine-Grained Sediment Dynamics, Coast of Surinam, South America. JOURNAL OF SEDIMENTARY PETROLOGY, 51(4):1053-1068, December 1981.

The prograding Holocene mud wedge between the Amazon and Orinoco Rivers in the trade wind belt of northeastern South America provides a modern-day example of muds accumulating under moderate wave-energy conditions. Gigantic shore-attached mudbanks (10 km × 20 km), composed partly of thixotropic fluid-mud gel, front this coast every 30-60 km to form a buffer to wave attack and a temporary storage for fine-grained sediments. This mesotidal coast (tide range ~2.0 m) with gentle offshore slope (0.0006) allows the exposure twice a day of extensive tidal flat deposits, which are backed by mangrove swamps on a well-developed chenier-plain complex. Field experiments were conducted in Surinam during 1975 and 1977 to provide new information on process-form relationships in this interesting but unusual muddy environment. Simultaneous measurements of waves, currents, tide elevation, suspended-sediment concentration, and variations in mud density show that soft intertidal and subtidal muds are suspended at both tide and wave frequency. Suspended-sediment concentrations typically exceed 1,000 mg/l at the surface as incoming solitarylike waves partially disperse fluid mud into overlying water on a falling or rising tide. Redeposition of mud may occur near time of high tide. The strong attenuation of shallow-water waves by these muds provides conditions that are favorable for further sedimentation. High concentrations of suspended fluid mud, together with solitarylike waves from the northeast throughout the year, can lead to extraordinarily high net sediment transport rates in the nearshore zone. Calculations based on solitary-wave theory and on data obtained from this study indicate that 15-65 × 10^6 m^3 of mud can move alongshore each year without involving breaking waves, the concept of radiation stress and a nearshore circulation cell, or bedload transport. Farther offshore, outside the zone of wave dominance, wind-driven currents and the Guiana Current combine to transport muds to the northwest, consistent with the observed direction of mudflat migration. References (43 items).

Whitlock, C.H., et al. Laboratory and Field Measurements of Upwelled Radiance and Reflectance Spectra of Suspended James River Sediments near Hopewell, Virginia. (See complete entry in Section VII.)

Wiegert, R.G. Modeling Salt Marshes and Estuaries: Progress and Problems. (See complete entry in Section VI.)

Williamson, K.J., and Bella, D.A. Estuarine Sediments: Successful Model. Journal of the Environmental Engineering Division, Proceedings, ASCE, 10b(EE4):695-710, August 1980.

Estuarine sediments are discussed with emphasis given to the sulfur cycle. Human activities alter estuarine sediments and adverse impacts can result. Toxic levels of free sulfide can build up within estuarine sediments and hydrogen sulfide can be released into the atmosphere. A conceptual model is presented that can serve as a practical basis for monitoring estuarine sediments and interpreting results. Methods for classifying estuarine sediments with a minimal amount of field effort are discussed. The model and methods presented allow description of changes in sediment characteristics in response to different natural and human imposed conditions. Experimental results are presented and discussed. References (20 items).

Winton, T.C. Long and Short Term Stability of Small Inlets. University of Florida, Coastal and Oceanographic Laboratory, UFL/COEL-79-004, June 1979.

The ability to predict inlet stability is of importance when considering safe navigation through or around inlet, water quality within the adjoining bay or estuarial system and beach erosion along the abutting shorelines. There are two aspects of this problem which must be considered when developing stability criteria, the first being the long-term stability problem. This aspect must consider the response of the inlet for a time ranging from a few months to perhaps a decade or more, during which time the inlet may either slowly shoal or remain fairly stable without significant change. The second aspect is the shorter termed problem, the problem of response under increased littoral drift and/or wave activity which may last for only a few days but which may lead to a sudden closure. The thrust of this study is to address the problem of short-term inlet stability by developing a computer simulated idealized inlet in which the major controlling variables, including the effect of inertia on the flow dynamics, are inherently or explicitly included and can respond to sudden or short-term variations in one or more of the variables. The model reveals that an inlet, stable under one set of littoral drift or wave energy conditions, becomes unstable and closes under a heavier littoral drift of under storm wave activity, a phenomenon which is typical of the closure of many small tidal inlets. The model has been used to simulate the closure of O'Brien's Lagoon, a small tidal lagoon on the southwest coast of Florida, and the results compared favorably with prototype data collected at this inlet. Bibliography.

Wright, L.D. Morphodynamics of a Wave Dominated River Mouth. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1721-1737.

The mouth of the Shoalhaven River on the southeast coast of Australia is subject to direct attack by high energy waves and offers a general model of wave-dominated river-mouth deposition. During river floods, seawater is

The chemical composition (Al, Si, Ti, K, Ca, Mg, P, Org. C, Fe, and Mn) of suspended material in the Tay Estuary and River Tay have been measured to determine the relation between river and estuary material and chemical reactions which may be occurring during estuarine mixing. Variations in the ratios of Fe/Al, Mn/Al, Ti/Al, etc., with salinity and suspended load during a tidal station suggest that sedimentological and hydrological processes, rather than chemical ones, are responsible for the observed compositional changes. This interpretation is confirmed by laboratory mixing experiments which also contradict published reports of Fe and Mn desorption in estuaries. Measurements of suspended matter composition will not easily determine whether desorption or adsorption of element occurs when river-borne suspended material enters the saline environment. A tentative conclusion on the River Tay study is that the suspended matter in the Tay Estuary results from the input of material at times of high suspended loads and of high river water discharge. References (48 items).

Sill, B.L., Fisher, J.S., and Whiteside, S.D. Laboratory Investigation of Ebb Tidal Shoals. (See complete entry in Section VI.)

Stephenson, R. Avon-Heathcote--Estuary Under Stress. (See complete entry in Section IV.)

Suszkowski, D.J., and Mansky, J.M. The Disposal of Sediments Dredged from New York Harbor. (See complete entry in Section V.)

Taylor, D. The Effect of Discharges from Three Industrialized Estuaries on the Distribution of Heavy Metals in the Coastal Sediments of the North Sea. (See complete entry in Section IV.)

Trawle, M.J. Georgetown Harbor, South Carolina, Report No. 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. (See complete entry in Section VI.)

Vincent, C.L., and Corson, W.D. The Geometry of Selected U. S. Tidal Inlets. (See complete entry in Section VIII.)

Vollmers, H. Harbour Inlets on Tidal Estuaries. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1854-1867.

This paper defines and discusses the reasons for sedimentation in Harbor mouths as (a) current effect (vortex in the harbor mouth caused by energy exchange), (b) tide effect (fill up of the harbor basin during the flood tide), and (c) density effect (density current caused by different salinity in the estuary and the harbor entrance). A case study of the primary and secondary vortices in the Ems-Estuary model is presented. References (5 items).

Vollmers, H. Sediment Transport. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 18, 1973.

Sediment transport in open channels is one of the very complex problems of hydraulics. In principle, a distinction is made here between transport by a current which always flows in the same direction (inland channel) and transport by a current whose direction is reversed at specific intervals (channel under tidal influence). Tidal currents are generally mixed streams; the fluctuation found in estuaries gradually become less marked upriver, as one direction becomes more and more dominant, until the tidal limit is passed and the sole current is that of the direction-constant discharge. It may be assumed that a direction-constant discharge in any observed area is uniform. It is therefore easier to establish facts of general validity, from which certain conclusions as to solid material transport characteristics can be drawn. The mechanisms associated with the constant alternation of current direction found in tidal regimes are incomparably more complex and still not known in detail. Apart from the difficulty of interpreting density and coriolis effects, solid-material transport is influenced by current acceleration and deceleration. The lecture is confined to direction-constant currents and is intended to provide the starting point for basic research into the conditions found when the current direction alternates. References (23 items).

Vollmers, H. Tidal Models with Movable Beds. (See complete entry in Section VI.)

Walton, T.L., Jr., and Adams, W.D. Capacity of Inlet Outer Bars to Store Sand. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1919-1937.

Inlets act as large sand sinks for sand derived from adjacent beaches. An attempt to quantify the amount of sand in an outer bar is made with the major governing parameter of inlet hydraulics, tidal prism. In areas of high wave activity there appears to be a well defined limiting relationship to the amount of sand stored in the offshore bar as a function of tidal prism. In areas where inlets are exposed to lower wave activity, more scatter is noted in this correlation. Relationships for estimating the equilibrium storage volume of sand in the outer bar/shoal of newly cut inlets in highly exposed, moderately exposed, and mildly exposed coasts (where degree of exposure relates to wave action offshore) are proposed for use in estimating quantities of sand which will eventually be lost to adjacent beaches. A conclusion of the study is that mo[illegible]d is st[illegible]red in the outer bar of a low energy coast than in the outer bar of a high energy coast. An upper limit to outer bar storage in low energy zones may be a function of additional parameters other than tidal prism such as longshore energy flux at the inlet site and inlet history. References (16 items).

Wang, D.-P. Observation and Modeling of the Circulation in the Chesapeake Bay. (See complete entry in Section VI.)

A systematic approach to study the sediment transport in shallow waters is presented. The approach combines mathematical modeling, remote sensing by satellite and aircraft, and laboratory and field experiments. Two- and three-dimensional hydrodynamic models are utilized and combined with significant wave models to account for the important mechanisms of sediment dispersion: convection, turbulent diffusion, gravitational settling, and resuspension and deposition at sediment-water interface. Two examples of model application are presented: (1) a feasibility study of direct pipeline discharge of dissolved solids into the Central Basin of Lake Erie; and (2) a realistic sediment dispersion event of 3 days in the Western Basin of Lake Erie. For the sediment dispersion event, the model successfully simulates the observed general sediment dispersion pattern as well as the significant concentration gradient in the horizontal direction. The bottom sediments underwent appreciable resuspension and deposition during the 3-day event, while the net change in sediment thickness over much of the basin was quite small. The basic approach can be extended to study the sediment transport in estuarine and coastal regions. References (36 items).

Shigemura, T. Characteristics of Tidal Inlets on the Pacific Coast of Japan. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1666-1680.

Tidal inlets on the Pacific coast of Japan were studies with respect to three characteristic variables of the throat section: (i) throat area; (ii) throat width; and (iii) direction of throat section. For each of these three varibles, multiple regression analysis was performed stepwise by introducing external variables such as tidal prism, mean flow rate of tidal flow, wind energy, wave energy, and so on into a linear regression model. Exposure condition of throat section to open sea was also introduced into the analysis. References (12 items).

Shigemura, T. Tidal Prism-Throat Area Relationships of the Bays of Japan. SHORE AND BEACH, 48(3):30-35, July 1980.

Bays on each coast of Japan have quite high correlation between their throat areas, A, and tidal prisms, P, although this correlation appears to be affected by the geometrical parameters, r_{as}, r_{wl}, and r_{dnr} of the bays. The bays on the coast of Japan hold quite reliable A-P relationships of the form of $A = CP^n$ if they are classified into certain groups based on the magnitude of the geometrical parameter, r_{as}. The values of n in each A-P relationship obtained from the classified bays do not change irrespective of the magnitude of r_{as} and of the location of the bays. Namely, the values of n in these A-P relationships range approximately from 0.8 to 1.0, which are surprisingly close to the values of n found by Jarrett and the other researchers from the tidal inlets located on sandy beaches along the coasts of the United States. The values of C in each A-P relationship obtained from the classified bays do change due to both the magnitude of r_{as} and the location of the bays. Namely, the values of C in these A-P relationships increase as the value of r_{as} increases. Further, in the case of the bays on the coast of the Japan Sea, the values of C are approximately ten times greater than those found from the bays on the other coasts of Japan. In the case of the bays on the coasts of Japan, the values of C in each A-P relationship are all considerably greater than those found from the tidal inlets located on the sandy beaches along the coasts of the United States, and the ratio of the former C values to the latter's often becomes greater than one hundred to one in the case of most bays on the coast of the Japan Sea and of some bays on both the Pacific coast and the west coast of Kyushu. References (9 items).

Shigemura, T. Tidal Prism-Throat Width Relationships of the Bays of Japan. SHORE AND BEACH, 49(3):34-39, July 1981.

Natural bays on four major coasts of Japan were investigated statistically to derive certain empirical relationships between their throat width and an external variable which has a predominantly high correlation with the throat width. To find the predominant external variable, ten variables were provided, which are somehow related to the environmental forces around the throat sections of natural bays. As a result, the following facts were found: (1) among the ten external variables provided, tidal prism, P, has a predominantly high correlation with the throat width of natural bays on the four major coasts of Japan, and quite a unique functional relationship of the form of $W_t = CP^n$ was derived between the throat width and tidal prism, (2) all of the original W_t-P equations found for the bays on each coast are refined remarkably if the analysis is performed again with due regard to the magnitude of the geometrical parameter, r_{wl}, of sampled bays, (3) the values of the exponent n in all refined W_t-P equations are almost constant ranging from 0.36 to 0.53, which are very close to the values of n in the converted regime equations found for the stable alluvial canals, (4) the values of C in all refined W_t-P equations are considerably greater than those in the converted regime equations found for the stable alluvial canals. Further, the values of C increase as does the magnitude of the geometrical parameter, r_{wl}. These values also vary from coast to coast, and in case of the bays of the Japan Sea coast, they are about twice the values of C found for the other three coasts. References (5 items).

Sholkovitz, E.R. Chemical and Physical Processes Controlling the Chemical Composition of Suspended Material in the River Tay Estuary. ESTUARINE AND COASTAL MARINE SCIENCE, 8(6): 523-545, June 1979.

Priessmann, A. Use of Mathematical Models. (See complete entry in Section VI.)

Proceedings of the Eighth Dredging Seminar, November 8, 1975. (See complete entry in Section V.)

Purpura, J.A. Performance of a Jetty-Weir Inlet Improvement Plan. (See complete entry in Section V.)

Qasim, S.Z., and Gupta, R.S. Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa. (See complete entry in Section III.)

Reneau, S.L. Recent Sedimentation Along the Big River Estuary. CALIFORNIA GEOLOGY, 34(12):255-259, December 1981.

This paper discusses the major geomorphic changes, resulting from substantial sedimentation, which have occurred in the estuary during this century. It reveals that the vegetation distribution on the salt marsh flats has changed because of this sedimentation. The historic development of levees displays the transition from a tidal system to a fluvial system. This process has proceeded extremely rapidly and major irreversible changes have occurred in the estuarine environment. Sedimentation following extensive land disturbances such as the logging activities along the Big River estuary has been recognized. In conclusion, it points out that excessive erosion from logging and other human activities must be controlled if estuaries are to be maintained as viable, productive ecosystems. References (9 items).

Renger, E. Quantitative Geomorphological Analysis of Erosional Topography with Respect to the Morphology of Tidal Basins. (See complete entry in Section VI.)

Richardson, T.W. Systems for Bypassing Sand at Coastal Inlets. (See complete entry in Section V.)

Rohde, H. Sand Movement Investigations by Means of Radioactive Tracers in a Hydraulic Model and in the Field. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:2027-2044.

The Lower and the Outer Elbe constitute the seagoing navigation channel which has the heaviest shipping traffic in the Federal Republic of Germany. In order to obtain and maintain the fairway depth necessary for shipping, river construction works and dredging are applied to an equal extent. The problems which result from the displacement of the sands and the fairways, as well as those of sediment transportation, are investigated in a model with a movable bed consisting of granulated polystyrol. Investigations have shown that experiments using radioactive tracers in a model with a movable bed give valuable indications concerning the sediment transportation to be expected in the field. In particular, it permits the determination of the direction of main movement. In the field, however, larger trans ortation distances are attained in a shorter time because the transportation takes place in suspension. In the model experiments, the deposition of the whole of the amount of the radioactive material introduced could be recorded exactly. References (8 items).

Ross, B.E., Anderson, M.W., and Jerkins, P. A Set of Coordinated Mathematical Models for the Coastal Zone. (See complete entry in Section VI.)

Scarlatos, P.D. On the Numerical Modeling of Cohesive Sediment Transport. (See complete entry in Section VI.)

Schubel, J.R., and Carter, H.H. Suspended Sediment Budget for Chesapeake Bay. Estuarine Research; Vol. II, Circulation, Sediments and Transfer of Materials in the Estuary, edited by Martin Wiley, New York, Academic Press, 1976, 48-63.

During periods of high riverflow the Susquehanna dominates the upper 20-30 km of the Bay: the net flow and sediment transport are seaward at all depths, and there is a marked downstream decrease in suspended sediment. With subsiding riverflow, a turbidity maximum is formed in the upper reaches of the Bay. In the middle and lower reaches of the Bay, shore erosion is not only a major source of organic sediment it may be the largest single source. The distributions of suspended sediment along the axis of the entire Bay are presented for a 12-month period in 1969-1970. References (28 items).

Sea Grant Publications Index 1979. (See complete entry in Section I.)

Sengupta, S., Lee, S.S, and Miller, H.P. Three-Dimensional Numerical Investigations of Tides and Wind-Induced Transport Processes in Biscayne Bay. (See complete entry in Section VI.)

Severn Tidal Power. (See complete entry in Section V.)

Seymour, R.J. Longshore Sediment Transport by Tidal Currents. JOURNAL OF GEOPHYSICAL RESEARCH, 85(C4):1899-1904, April 20, 1980.

A mechanism for longshore sediment transport outside the surf zone is proposed on the basis of the variation in bottom stress under stationary waves produced by tidal depth changes. The variation in stress is in phase with the longshore component of tidal velocity and is shown to produce a net transport counter to the direction of the advance of the tide along the coast. An analytical model for predicting tidal transport is developed and is applied to measurements of tidal currents and waves near Oceanside, California, over a 3-week period. The tidal transport rate decreases rapidly with depth, and the total net transport is shown to be a very small fraction of that anticipated from wave-driven currents at that location. References (10 items).

Sheng, Y.P. Modeling Sediment Transport in a Shallow Lake. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 299-337.

SECTION IV. CONTAMINATION

Contamination from sources such as industrial wastes or sewage, as disting·'shed from contamination by salt water.

Anderson, F.E. The Variation in Suspended Sediment and Water Properties in the Flood-Water Front Traversing the Tidal Flat. (See complete entry in Section II.)

Armangau, C., and Burkhalter, R. Utilisation de la télédéction pour la résolution de problèmes d'hydrodynamique et de pollution en zones lagunaires et côtières (Teledection for Solving Hydrodynamics and Pollution Problems in Lagoon and Coastal Waters). (See complete entry in Section VII.)

Bale, A.J., and Morris, A.W. Laboratory Simulation of Chemical Processes Induced by Estuarine Mixing: The Behaviour of Iron and Phosphate in Estuaries. ESTUARINE, COASTAL AND SHELF SCIENCE, 13(1):1-10, July 1981.

A series of well stirred tank reactors has been shown to provide an adaptable laboratory analogue of a one-dimensional estuarine mixing profile which can be applied dynamically to the study of the chemistry of estuarine mixing. Simulations of the behavior of iron and phosphate in the low salinity region of an estuary have been achieved with this system. The well documented general features of iron removal, involving rapid aggregation of riverborne colloids, were reproduced. Phosphate removal is attributable in part to the coagulation process, although specific adsorption of phosphate by colloids also appears to be significant. References (33 items).

Battelle Pacific Northwest Laboratories. Development of a Mathematical Water Quality Model for Grays Harbour and the Chehalis River, Washington. (See complete entry in Section VI.)

Bell, P.R., et al. Measurement and Analysis of the Effects of Stormwater on the Lane Cove Estuary. TRANSACTIONS OF THE INSTITUTION OF ENGINEERS, AUSTRALIA, CIVIL ENGINEERING, CE23(1): 1-6, January 1981.

The quality and flow of storm water from the urbanised catchment of the Lane Cove River were monitored for several storm events. Effects of storm water on the hydraulics, mixing, and quality of the receiving estuarine system were measured and analyzed. The relative impact of a major sewer overflow in the lower reaches of the estuary was determined using a fluorescent-dye tracer. A mathematical model describing the replenishment of dissolved oxygen to the system was developed. Supplemental aeration of affected waters in the upper reaches of the estuary does not appear to be practical. References (5 items).

Bella, D.A., and Williamson, K.J. Simulation of Sulfur Cycle in Estuarine Sediments. (See complete entry in Section VI.)

Beltrami, E., and Carroll, T.O. A Land-Use Planning Model for Coastal Zone Management. COASTAL ZONE MANAGEMENT JOURNAL: ENVIRONMENT RESOURCES AND LAW, 4(1-2):83-96, 1978.

A linear programming model for assessing the aggregate impact of land-use activities scattered over a large area on the resultant pollutant concentrations in coastal waters is considered and the dispersion to coastal waters of the adverse environmental loads generated by the land uses is described by a set of transport coefficients that measure the attenuation of pollutants, e.g., industrial BOD carried to the coast along surface drainage basins. Further dispersion in the waters caused by tidal action is described by pollution susceptibility procedure. The model minimizes the steady-state concentrations of pollutants by establishing an optimal spatial configuration of residential, commercial, and industrial land uses. This configuration is constrained by a number of restrictions based on local and regional targets for growth and development. The methodology discussed should be useful to regional planners and is based on a study conducted for the Long Island area. References (4 items).

Bennett, J.P. Calibration of Branched Estuary Models. (See complete entry in Section VI.)

Bennett, N.J. Initial Dilution: A Practical Study on the Hastings Long Sea Outfall. (See complete entry in Section VII.)

Bloom, H., and Ayling, G.M. Heavy Metals in the Derwent Estuary. ENVIRONMENTAL GEOLOGY, 2(1):3-22, 1977.

Analyses of the concentrations of Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, and Zn in filtered waters, suspended particulates, sediments, shellfish, fish, airborne particulates, and sewage confirmed work of other investigations showing that the Derwent Estuary is heavily contaminated, particularly with Hg, Cd, Pb, and Zn, and added further information regarding the distribution of each metal. Apparently most of the contamination originated from the earlier operation of a zinc refining plant. A study of shellfish growing in variously contaminated regions found that 20 species could be listed in order of their respective abilities to accumulate each heavy metal. For example, the mussel (*Mytilus edulis*) was a good indication of Cd and Hg contamination, but less valuable as an indicator of Zn. The surf barnacle (*Catophragmus polymerus*) was one of the most sensitive biological indicators of Cd contamination. An indication of the steps by which a waste metal is eventually accumulated at high and even toxic concentrations in seafoods may be seen from a comparison of the relative concentrations of Cd, Pb, Hg, and Zn found in mussels, sediments, suspended particulates, and filtered waters. The high concentrations recorded for metals include the following: 1,100 μg/g Hg, 10,000 μg/g Zn, and 862 μg/g Cd in dried sediments; 1,500 μg/g Cd in airborne dust fallout; 200 μg/g Cd and 100,000 μg/g Zn in dried oysters; and 16 μg/l Hg, 15 μg/l Cd and 1,500 μg/l Zn in filtered waters. References (65 items).

Bopp, R.F., et al. Polychlorinated Biphenyls in Sediments of the Tidal Hudson River, New York. ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 15(2):210-216, February 1981.

As the result of discharges of PCBs from two manufacturing facilities on the upper Hudson River between ca. 1950 and 1976, recent sediments of the tidal Hudson have been contaminated to an average level of ~10 ppm. This is

1-2 orders of magnitude higher than levels in a number of other large rivers and estuaries that have been studied. The degree of contamination decreases regularly with distance downstream from the source. Downstream changes in PCB composition along the axis of the Hudson can be understood qualitatively in terms of suspended matter-water partitioning of PCB components. The presence of ^{137}Cs in the sediments can be used as an independent indication of sediment deposition since the era of atmospheric testing of nuclear weapons. ^{137}Cs and PCB depth profiles in cores are used to determine a first-order PCB budget for sediments of the tidal Hudson and to indicate regional levels of PCB contamination prior to the large point-source discharges to the upper Hudson. References (24 items).

Brocard, D.N., and Hsu, S.-K. Mathematical Modeling of Heated Surface Discharge in Confined Tidal Estuary: Mercer Generating Station. Report 68-78/M302DF, Holden, Worcester Polytechnical Institute, Alden Research Laboratory, 191 p, 1978.

A mathematical model was developed for the prediction of the temperature rises in the Delaware River, associated with the waste heat discharge from the Mercer Generating Station. This mathematical model included a transient one-dimensional model to account for the effects of the meteorology and of the tidal velocity fluctuations in the Delaware River. Also, part of the overall model was an integral jet model which allowed the prediction of the three-dimensional temperature rise patterns produced by the heated discharge. References (19 items).

Brocard, D.N., Hsu, S.-K., and Walker, C. Mathematical Modeling of Heated Surface Discharge in Confined Tidal Estuary, Ravenwood Generating Station. Report 46-79/M118NF, *Worcester Polytechnic Institute*, Alden Research Laboratory, April 1979.

The Ravenswood Generating Station, owned and operated by Consolidated Edison Company of New York, is located on the eastern shore of the East River in Queens County, New York City, facing the central portion of Roosevelt Island. This station comprises three oil fired units with a maximum generating capacity of approximately 1,800 MWe and uses a once-through condenser cooling system withdrawing from and discharging into the East River. In order to show compliance with NPDES discharge permit conditions, the distribution of temperature rises induced by the plant heated discharge was determined for various plant operating conditions and riverflows. The flow in the East River is characterized by reversing currents of large amplitude, which are driven by the tides in New York Harbor and Long Island Sound. As a result, the ambient water which is entrained in the discharge jet and provides for dilution may contain heat discharged prior to the current direction reversal, leading to a background temperature rise. Also, heat is discharged in the East River by five other generating stations, and their effect was taken into account. In order to account for the above phenomena and to make temperature rise determinations for a number of conditions, a mathematical modeling approach was selected. The mathematical model included two parts: a transient one-dimensional model was used to predict the background temperature rise resulting from tidal effects and the other head discharges and a steady jet model was used to calculate the three-dimensional distribution of temperature rises in the Ravenwood discharge plume. The final temperature predictions were obtained by the combination of the two models. The transient one-dimensional model showed that the background temperature rise is little affected by the strength of the tide (Neap, Mean, or Spring) and, consequently, only conditions corresponding to two surveys of the Ravenswood plume, and the results were found to compare favorably. The plume model was then run with river currents corresponding to six times during the tide cycle and the results are presented in terms of surface and subsurface temperature rise isotherms. For most river currents, the Ravenswood plume was found to be attached to the Ravenswood shore. Only near slacks did the discharge plume reach Roosevelt Island. References (32 items).

Chapra, S.C., and Gordimer, S. Documentation of ES0001. (See complete entry in Section VI.)

Chatwin, P.C. Presentation of Longitudinal Dispersion Data. (See complete entry in Section I.)

Chen, W.T., ed. Applications of Remote Sensing to the Chesapeake Bay; Volume 1, Executive Summary. (See complete entry in Section VII.)

Christensen, E.R., and Scherfig, J. Metals from Urban Runoff in Dated Sediments of a Very Shallow Estuary. ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 12(10):1168-1173, October 1978.

Pollution sources for Newport Bay, California, are of a nonpoint nature. To assess the heavy metal pollution of sediments in Upper Newport Bay, receiving runoff from a watershed of 376 km^2, a number of sediment cores are dated and analyzed for Cr, Mn, Fe, Co, Cu, Zn, and Pb. The sedimentation rate is determined to be about 1.8 cm/yr by three independent methods: Pb-210 dating of selected cores, correlation between long-term oscillations in rainfall and similar variations versus depth of grain size and heavy metal content in cores from tidal flats, and estimation of the settleable solids budget. Vertical profiles of heavy metals in dated sediment cores indicate that Zn and Pb are the only metals of those investigated that show clearly increased levels in the uppermost strata, deposited since about 1955, when urban development in the watershed began. References (16 items).

Christodoulou, G.C., and Connor, J.J. Dispersion in Two-Layer Stratified Water Bodies. (See complete entry in Section VI.)

Clark, L.J., Ambrose, R.B., Jr., and Crain, R.C. A Water Quality Modelling Study of the Delaware Estuary. (See complete entry in Section VI.)

Conomos, T.J. Movement of Spilled Oil in San Francisco Bay as Predicted by Estuarine Non-tidal Drift. In: Marine Pollution Monitoring (Petroleum) Proceedings of a Symposium and Workshop (Gaithersburg, U.S.A.: May 13-17, 1974), Washington, U.S.A., National Bureau of Standards Special Publication 409, December 1974, 97-100.

Surface and seabed drifters were released every 2 months between 1970 and 1973 in San Francisco Bay. Data obtained during the course of this study and from an actual oil spill which occurred during this period are used to predict possible pathways of oil on the surface and in the body of water. References (16 items).

Cooke, J.C. Dispersal of Microfungi in the Thames River Estuary of Eastern Long Island Sound. (See complete entry in Section VII.)

Costas, P. Potomac Estuary Tapped for Pilot Study. WATER AND SEWAGE WORKS, 125(11):64-67, November 1978.

With the Water Resources Development Act of 1974, Congress directed the ACE to study the feasibility of using the Potomac estuary as a water supply source. Construction of an experimental plant is currently under way at a 2-acre site at the Blue Plains Water Pollution Control Plant, Washington, D.C. The mainstream processes for the experimental plant include microscreening, aeration, coagulant addition, rapid mixing, flocculation, sedimentation, filtration, carbon adsorption, and disinfection. A 10,000-gpd side stream will be used to assess the performance of ion exchange, electrodialysis, and RO in the removal of dissolved solids. The side stream contains postdisinfection facilities using ozone, Cl, or UV light. The experimental plant is to be equipped with facilities that will treat byproducts of the mainstream processes by recovering chemicals that can be reused, cycling supernatants back to the mainstream process, and producing acceptable dry residual solids for disposal. Most plant waste discharges will be returned to the raw water source. The chemical recovery system has the capability for evaluating the use of recycled coagulants and effectiveness of the process in terms of buildup of inert materials. Laboratory facilities will analyze routine water quality. More complex analytical work will be performed in the Washington Aqueduct laboratories at the Dalecarlia Water Treatment Plant. Virological, parasitological, and preliminary toxicological screening will be performed on a contact basis by outside laboratories. References (2 items).

Crouzet, P., and Boissard, P. Rejets pollutants de Saint-Malo et Dinard dans l'estuaire de la Rance (Pollution of the La Rance Estuary by Effluents from Saint-Malo and Dinard). LA HOUILLE BLANCHE, 33(7/8):561-568, 1978. (In French.)

The raw sewage from Saint Malo and Dinard (86,000 and 22,000 inhabitants, respectively) discharges into the estuary at a point below the La Rance tidal power plant. An aerial teledection survey carried out in June 1976 had the following objectives: (a) Observation of the behavior of each of the two outfalls and respective methods of operation and (b) Evaluation of hydrodynamic conditions in the estuary, to obtain data for future river-cleansing and sewerage system operation programs. With discussion.

Daly, M.A., and Mathieson, A.C. Nutrient Fluxes Within a Small North Temperate Salt Marsh. MARINE BIOLOGY, 61(4):337-344, 1981.

The water exchange between a small (4.1 hectare) salt marsh adjoining the Great Bay Estuary System of New Hampshire, US, was sampled during 16 tidal cycles between July 1976 and November 1977. Tidal amplitude, temperature, salinity, nutrient concentrations (ammonia-N, nitrate-N, nitrite-N, orthophosphate-P, total-P, silicates), and suspended particulates were measured. Conspicuous tidal hydrographic patterns were observed. Mean concentrations of nitrate-N and silicates varied with season. The tidal information, combined with volume determinations, was extrapolated to determine the net flux of hydrographic parameters on monthly and yearly basis. Ammonia-N showed a pronounced seasonality of net exchange by regression analyses.

DeGroot, A.J. and Salomons, W. Influence of Civil Engineering Projects on Water Quality in Deltaic Regions. Paper to: IAHS-UNESCO Symposium on Effects of Urbanisation and Industrialization on the Hydrological Regime and on Water Quality, Amsterdam, The Netherlands: October 1977. Delft, The Netherlands, Delft Hydraulics Laboratory, Publication No. 195, November 1977, 7p.

The Dutch coastal region contains the mouths of a number of rivers (Rhine, Meuse, Scheldt) which are polluted to a considerable extent with heavy metals. The pollutants are largely associated with the suspended matter in the water. In the estuaries and lagoons these solids were formerly diluted with relatively uncontaminated marine material and subsequently mainly transported out to sea. Meanwhile, civil engineering projects have resulted in the enclosure of the river mouths (Delta plan) and a lagoon (former Zuyder Sea), as well as in the construction of large harbors (Rotterdam). The creation of freshwater lakes and deep harbors favors the sedimentation of polluted material and restricts discharge out to sea. Furthermore, the longer residence times of the river water in these reservoirs gives rise to an increase in pH and an enhanced adsorption of dissolved pollutants to the sediments. The above-mentioned processes were studied for many years in the relevant areas. The consequences of the enhanced retention of polluted sediments will be discussed with respect to environmental quality. References (8 items).

Duinker, J.C., and Nolting, R.F. Dissolved and Particulate Trace Metals in the Rhine Estuary and the Southern Bight. MARINE POLLUTION BULLETIN, 8(1977)3, March 65-71.

Dissolved and particulate trace metals have been measured in the Southern Bight and Rhine estuary in order to study the relative importance of precipitation and sedimentation processes as compared to mobilization processes in the estuary, and their impact on trace

metal levels in the Southern Bight. References (17 items).

Dye, A.H. Tidal Fluctuations in Biological Oxygen Demand in Exposed Sandy Beaches. ESTUARINE AND COASTAL MARINE SCIENCE, 11(1):1-8, July 1980.

Tide-induced fluctuations in biological oxygen demand (BOD) on two medium to fine sandy beaches were recorded over two separate 24-hr periods in February (summer) 1979. Fluctuations in BOD of over two orders of magnitude were found with the highest occurring at or just after high tide and the lowest at low tide. Greatest fluctuations occurred at the higher tidal levels as well as near the surface of the substratum. Significant correlations between BOD and the degree of water saturation of the sand were found, although no such correlations with either bacterial or protozoan numbers or temperature occurred. It appears that in areas of the beach where the water content decreases to 30 percent or less, BOD is greatly reduced and increases again only upon rewetting by the incoming tide. Measurements of BOD made during low tide in such areas may underestimate oxygen consumption by as much as 300 percent. Conversely, measurements made on saturated sediments only may be overestimates of a similar magnitude. References (30 items).

Dyer, K.R. Lateral Circulation Effects in Estuaries. (See complete entry in Section I.)

Eaton, A. Observations on the Geochemistry of Soluble Copper, Iron, Nickel, and Zinc in the San Francisco Bay Estuary. ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 13(3):425-432, April 1979.

At discharges of 300-400 m^3/s, surface waters of the San Francisco Bay estuary contain dissolved CU and Ni at levels of 1 to 4 ppb. This is approximately an order of magnitude higher than waters outside the Bay. Zn concentrations are 2-6 ppb within the estuary and generally less than 1 ppb outside. Cd concentrations are 0.08 to 0.2 ppb within the estuary and 0.05 to 0.11 ppb outside. The behavior of all these elements is probably dominated by physical processes during most seasons, although Cu shows evidence for removal during summer months when riverflow is low. Cu, Ni, and Zn show an excess of about 1 ppb relative to conservative mixing in the more saline portion of the estuary. This excess is attributed to municipal and industrial discharges. Literature Cited (47 items).

Eaton, A. Removal of 'Soluble' Iron in the Potomac River Estuary. ESTUARINE AND COASTAL MARINE SCIENCE, 9(1):41-49, July 1979.

'Soluble' iron levels in the Potomac River estuary are extremely low, usually less than 0.5 μM at mile 90 (fresh water) and decrease downstream to less than 0.05 μM prior to the intrusion of salt water. Removal of 'soluble' and fine filterable iron in the fresh water obeys first order kinetics with a rate constant of about 0.1 day^{-1}. Addition of bacteriocides to samples stabilizes iron concentrations, suggesting that in this estuary freshwater colloids are destabilized by bacterial polymers. The extensive removal of iron in fresh waters is a different phenomenon from the salinity-dependent removal observed by several other workers in different estuaries. References (15 items).

Edge, B.L., O'Brien, J.F., and McCoy, J.E. Methodology for Siting Power Plants on Industrialized Estuaries. Clemson University, Water Resources Research Institute, Report No. 77, September 1979.

There is, at the present time, considerable economic activity concentrated on or near the coastal and estuarine waters of the United States. The trend toward increased development of industrial and urban activities is expected to continue for these areas. The cities and industries of the future will be needing ever-increasing amounts of electrical energy, much of which will be produced in new generating facilities nearby. Great quantities of waste heat will be rejected to the cooling water. This cooling water will, in all likelihood, be the same water that is used by the cities and industries in the vicinity for a variety of beneficial purposes. There is today an ever-increasing demand for the protection and management of environmental quality in coastal and estuarine waters. When a large thermal power plant is to be located on an estuary, an analysis should be made of the complex interactions which exist between thermal discharges from the power plant and other wastes from urban and industrial sources which are discharged into the estuary. Mathematical models were developed which consider these interactions, which can, under certain conditions, be quite significant. The methodology provides an approach which can be utilized by an environmental protection agency as well as a power company to evaluate the environmental impact of locating a new thermal power generating facility at alternate potential sites. The methodology developed was applied to a straightforward one-dimensional estuary example. The purpose was to demonstrate the water quality response when a large thermal power plant is located on a developed estuary near other activities which produce wastes whose transport or dissipation processes in the receiving waters are temperature-dependent. Additionally, the methodology was extended to a stratified estuary, and an example was presented to show the applicability to a real situation. The illustrative examples demonstrate the magnitude of the potential problems which could result from ignoring the interaction of thermal and other wastes. In some instances, the interactive or indirect aspects of thermal discharges may be much more important in their effect on water quality parameters than the direct effects usually considered in the siting process. The value of the approach developed in providing a realistic indication of the full environmental effects of a heated discharge at alternative sites is presented. Bibliography (71 items).

Edinger, J.E., and Buchak, E.M. Numerical Hydrodynamics of Estuaries. (See complete entry in Section VI.)

Falconer, R.A. Application of Numerical and Physical Models in Harbour Design. (See complete entry in Section VI.)

Finley, R.J., and Baumgardner, W., Jr. Interpretation of Surface-Water Circulation, Aransas Pass, Texas, Using Landsat Imagery. (See complete entry in Section I.)

Fischer, H.B., ed. Transport Models for Inland and Coastal Waters. (See complete entry in Section VI.)

Flugge, G. Horizontal Diffusion in Tidal Models and Scaling Criteria for Thermal Hydraulic Model Tests. (See complete entry in Section VI.)

French, R.H. Interfacial Instability in Stratified Flow. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3124-3137.

When heated water from a thermal power plant is discharged onto the free surface of an estuary or river, a density stratified flow consisting of superposed layers of hot and cold water is established. Such a flow is characterized by an initially stable interface at which there is zero velocity difference and a decaying density difference. Since it is known that after the density difference has decayed sufficiently the interface will be destroyed by turbulent eddies generated at the bottom boundary, it is pertinent to inquire if the point of interfacial stability can be easily located. It is the purpose of this paper to examine the question of interfacial stability in the presence of boundary generated turbulence and in the absence of interfacial shear. References (7 items).

Garnett, P.H. Thoughts on the Need to Control Discharges to Estuarial and Coastal Waters. WATER POLLUTION CONTROL, 80(2):172-179, 1981.

The author suggests that a period of change is being entered where control over the discharge of sewage and industrial effluents will be exercised to a defined purpose and not so much as has, no doubt, occurred in the past to maintain water quality for unspecified purposes. In applying the experience gained with control over nontidal waters to tidal waters, the same general principles should apply, which are that quality objectives should be stated and consent conditions set in order to allow the objectives to be met. The need to provide a measure of control in order that the United Kingdom can meet certain international obligations may well provide just the right degree of stimulus to get the control over discharges to estuarial and coastal waters off to a steady start.

Giese, G.L., Wilder, H.B., and Parker, G.G., Jr. Hydrology of Major Estuaries and Sounds of North Carolina. US Geological Survey, Raleigh, N. C., Water Resources Investigations 79-46, July 1979.

Knowledge of the basic hydrology of North Carolina's major estuaries and sounds is necessary to help solve hydrology related estuarine problems which include contamination of some estuaries with municipal and industrial wastes and drainage from adjacent intensively farmed areas, nuisance-level algal blooms, excessive shoaling in some navigation channels, saltwater intrusion into usually fresh estuarine reaches, too-high or too-low salinities in nursery areas for various estuarine species, and flood damages due to hurricanes. Saltwater intrusion occurs from time to time in all major estuaries except the Roanoke River, where releases from Roanoke Rapids Lake and other reservoirs during otherwise low-flow periods effectively block saline water from the estuary. References (78 items).

Goldberg, E.D., et al. Pollution History of the Savannah River Estuary. ENVIRONMENTAL SCIENCE AND TECHNOLOGY, 13(5):588-594, May 1979.

Records of natural and pollutant fluxes to the Savannah River estuarine system are found in some river and marsh deposits into which time frames can be introduced by ^{210}Pb or plutonium geochronologies. Plutonium releases from the Savannah River Plant to the environment are evident in only one deposit and in marsh grass, both of which have elevated levels of the $^{238}Pu/^{239+240}Pu$ ratios in comparison to those expected from atmoshpheric fallout. The highest concentrations of metals were found in deposits upriver; in sediments of the estuary itself, lower concentrations of the metals resulted from their dilution through the entry of oceanic solid phases. Literature Cited (16 items).

Gordon, R.B., and Spaulding, M.L. A Nested Numerical Tidal Model of the Southern New England Bight. (See complete entry in Section VI.)

Goyal, S.M., Gerba, C.P., and Melnick, J.L. R^+ Bacteria in Estuarine Sediments. MARINE POLLUTION BULLETIN, 10(1):14-27, January 1979.

Increased construction of coastal canal communities had led to a deterioration of the water quality in the canals. In addition to being used for recreational activities, the canals serve as a dumping place for domestic sewage from these communities. This study was conducted to determine the prevalence of transferable drug-resistance (R^+) bacteria in six coastal canals. A significantly higher number of R^+ bacteria (both pathogenic and nonpathogenic) occurred in the bottom sediments than in the overlaying water. These sediments can be resuspended following rain, dredging, storms, boating, and diving, thus releasing their bacterial populations into the overlaying water. References (11 items).

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. (See complete entry in Section I.)

Haller, D.L. Demonstration of Advanced Dredging Technology Dredging Contaminated Material (Kepone) James River, Virginia. (See complete entry in Section V.)

Hamaguchi, S. Pollution Studies at Tsu-Matsuzaka Harbor and Removal of Sediment at Estuaries near It. (See complete entry in Section V.)

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. (See complete entry in Section I.)

Harriss, R.C., Ribelin, B.W., and Dreyer, C. Sources and Variability of Suspended Particulates and Organic Carbon in a Salt Marsh Estuary. (See complete entry in Section II.)

Hudson, R.Y., et al. Coastal Hydraulic Models. (See complete entry in Section VI.)

Jensen, P., Rola, A., and Tyrawski, J. Tidal Wetlands and Estuarine Coliform Bacteria. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 385-399.

High concentrations of indicator bacteria (total and fecal coliforms) are common in Delaware estuarine waters which have large areas of adjacent tidal wetlands. The relation between tidal wetlands and these high coliform bacteria levels is explored through direct observation and statistical analysis of possible causative factors. Statistical analyses are performed on two representative tidal rivers using data collected by the state as part of its water quality monitoring program. Statistical results are used to suggest possible mechanisms for wetlant/coliform bacteria interactions and to identify those parameters which are most important in a predictive model of estuarine coliform bacteria concentrations. References (29 items).

Jones, G.B., and Jordan, M.B. The Distribution of Organic Material and Trace Metals in Sediments from the River Liffey Estuary, Dublin. ESTUARINE AND COASTAL MARINE SCIENCE, 8(1):37-47, January 1979.

Sediments of the River Liffey Estuary have been analyzed for organic carbon, Kjeldahl nitrogen, humic acid, and crude fiber contents. Several trace metals were also analyzed. The hydrographic conditions which control the transport of this material were also studied over a tidal cycle. Results indicate that the upper reaches of the estuary are isolated from the incoming seawater and that trace metal enrichment is localized. This metal enrichment is accompanied by an increase in the organic carbon, nitrogen, and humic acid levels. References (30 items).

Kato, M., and Wada, A. Adaptability of Prediction Method of Hydraulic Model Experiment for Thermal Diffusion. (See complete entry in Section VI.)

Klumpp, D.W., and Peterson, P.J. Arsenic and Other Trace Elements in the Waters and Organisms of an Estuary in SW England. ENVIRONMENTAL POLLUTION, 19(1):11-20, May 1979.

Arsenic, cadmium, copper, and zinc occur at elevated levels in the waters of Carnon River and the upper reaches of Restronguet Creek, these concentrations decreasing progressively toward the estuary of Carrick Roads. While arsenite is the main form of As in the Carnon River, this is converted to arsenate in the lower estuary. *Organisms analyzed from* Restronguet Creek reflect the As concentration in the water, this being most clearly evident in macrophytes. Although accumulated at all trophic levels, there was no evidence for biomagnification of As on an entire organism basis. The As was shown to exist in selected organisms as a compound(s) which forms on hydrolysis, dimethylarsinate, and traces of arsenate and methylarsonate. References (27 items).

Krause, G. Physical Processes in Tidal Estuaries in Relation to the Monitoring of Water Quality. (See complete entry in Section III.)

Kuo, A.Y., and Jacobson, J.P. Prediction of Pollutant Distribution in Estuaries. (See complete entry in Section VI.)

Larsen, L.H. Dispersion of Passive Contaminant in Oscillatory Fluid Flows. (See complete entry in Section III.)

Leendertse, J.J., and Liu, S.K. State Estimation of Estuarine Circulation and Water Quality by Numerical Simulation and Observation. (See complete entry in Section VI.)

Leendertse, J.J., and Nelson, A.B. A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Volume IX, The Computer Program. (See complete entry in Section VI.)

Lepetit, J.P., and Moreau, S. Study of an Artificial Island. (See complete entry in Section VI.)

Liu, S.-K., and Leendertse, J.J. Multidimensional Numerical Modeling of Estuaries and Coastal Seas. (See complete entry in Section VI.)

McDowell, D.M. Modelling Methods for Unsteady Flows. (See complete entry in Section VI.)

Nece, R.E., Galconer, R.A., and Tsutsumi, T. Planform Influence on Flushing and Circulation in Small Harbors. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, July 11-17, 1976, *Honolulu, Hawaii*, IV:3471-3486.

Laboratory data showing the influence of planform geometry on the tidal flushing characteristics of small harbors of simple surface shape. The tide ranges, water depths, and planform areas are typical of those encountered in *small-boat marinas* in Puget Sound, Washington. Each harbor investigated had a single, asymmetric entrance. Flushing and circulation patterns within such harbors depend strongly upon the characteristics of the angular momentum established within the basin and upon the effective penetration distance into the basin of the stream of ambient water entering the harbor on the flood tide. Experimental results confirm that best gross tidal flushing occurs when rectangular harbors have an aspect ratio L/B near unity, and that rounding interior corners of the basin has little effect on the gross tidal flushing but does improve local exchange. Aspect ratios L/B less than 3 lead to the creation of more than one circulation cell (gyre) within the basin. References (8 items).

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients; Proceedings of an International Symposium on the Effects of Nutrient Enrichment in Estuaries, Williamsburg, Virginia, 29-31 May 1979. Humana Press, Clifton, N. J., 1981.

Contents: Special Characteristics of Estuaries by Robert B. Biggs and L. Eugene Cronin. Conceptual Models and Processes of Nutrient Cycling in Estuaries by Kenneth L. Webb. Physical and Geological Processes Controlling Nutrient Levels in Estuaries by Donald W. Pritchard, and Jerry R. Schubel. Studies of Eutrophication in Lakes and Their Relevance to the Estuarine Environment by D. W. Schindler, Sources of Nutrients and the Scale of Eutrophication Problems in Estuaries by Norbert A. Jaworski. Remineralization and Nutrient Cycling in Coastal Marine Ecosystems by Scott W. Nixon. Uptake of Major Nutrients by Estuarine Plants by James J. McCarthy. Indicators and Indices of Estuarine Enrichment by A. J. McErlean and Gale Reed. Modeling of Eutrophication in Estuaries by Donald J. O'Connor. Nutrient Enrichment and Estuarine Health by Rezneat M. Darnell and Thomas M. Soniat. Impact of Nutrient Enrichment on Water Uses by John H. Ryther and Charles B. Officer. Management Implications of Nutrient Standards by Michael A. Bellanca. The Effects of Treated Sewage Discharge on the Biota of Port Phillip Bay, Victoria, Australia, by D. M. Azelrad and others. Estuaries and Coastal Lagoons of South Western Australia by Ernest P. Hodgkin and R. C. Lenanton. Eutrophication in the Peel-Harvey Estuarine System, Western Australia, by A. J. McComb and others. The Use of Nutrients, Salinity, and Water Circulation Data as a Tool for Coastal Zone Planning by Y. Monbet and others. Reversal of the Eutrophication Process: A Case Study by Gerald A. Moshiri and others. Responses of Kaneohe Bay, Hawaii, to Relaxation of Sewage Stress by S. V. Smith. Nitrification in the Upper Tidal James River by Carl F. Cerco. Eutrophication Trends in the Water Quality of the Rhode River (1971-1978) by David L. Correll. Aboveground Net Primary Productivity of Three Gulf Coast Marsh Macrophytes in Artificially Fertilized Plots by Armando A. de la Cruz and others. Nitrification and Production of N_2O in the Potomac: Evidence for Variability by James W. Elkins and others. Photosynthesis, Extracellular Release, and Heterotrophy of Dissolved Organic Matter in Rhode River Estuarine Plankton by Maria A. Faust and Ryszard J. Chrost. Enrichment of a Subtropical Estuary with Nitrogen, Phosphorus, and Silica by Thomas H. Fraser and William H. Wilcox. A Suggested Approach for Developing Water Quality Criteria for Management of Eutrophication by Norbert A. Jaworski and Orterio Villa, Jr. The Significance of Dredging and Dredged Material Disposal as a Source of Nitrogen and Phosphorus for Estuarine Waters by R. Anne Jones and G. Fred Lee. The Effects of Sewage Discharge into a Wind-Induced Plume Front by W. J. Kimmerer, T. W. Walsh, and J. Hirota. Application of the OECD Eutrophication Modeling Approach to Estuaries by G. Fred Lee and R. Anne Jones. Phosphorus and Nitrogen Limited Phytoplankton Productivity in Northeastern Gulf of Mexico Coastal Estuaries by Vernon B. Meyers and Richard I. Iverson. Short Term Changes in the Vertical Salinity Distribution of the York River Estuary Associated with Neap-Spring Tidal Cycle by Leonard W. Hass, Frederick J. Holden, and Christopher S. Welch. Time Varying Hydrodynamics and Water Quality in an Estuary by C. F. D'Elia, K. L. Webb, and R. L. Wetzel. Inorganic Nitrogen Regeneration and Total Oxygen Consumption by the Sediments at the Mouth of the York River, Virginia, USA, by William C. Phoel, K. L. Webb, and C. F. D'Elia. Photoplankton Response to a Stratification-Mixing Cycle in the York River Estuary During Later Summer by Leonard W. Haas, Steven J. Hastings, and Kenneth L. Webb. References at end of each paper.

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. (See complete entry in Section I.)

Nihoul, J.C.J., Runfola, Y., and Roisin, B. Shear Effect Dispersion in a Shallow Tidal Sea. (See complete entry in Section I.)

Nixon, S.W. Between Coastal Marshes and Coastal Waters--A Review of Twenty Years of Speculation and Research on the Role of Salt Marshes in Estuarine Productivity and Water Chemistry. (See complete entry in Section III.)

Nystrom, J.B., Hecker, G.E., and Moy, H.C. Heated Discharge in an Estuary: Case Study. (See complete entry in Section VI.)

O'Connor, B.A., and Thompson, G. A Mathematical Model of Chloride Levels in the Wear Estuary (UK). (See complete entry in Section VI.)

Officer, C.B. Box Models Revisited. (See complete entry in Section VI.)

O'Kane, J.P. Estuarine Water-Quality Management with Moving Element Models and Optimization Techniques. (See complete entry in Section VI.)

Ozturk, Y.F. Mathematical Modeling of Dissolved Oxygen in Mixed Estuaries. (See complete entry in Section VI.)

Parker, G.C., Fang, C.S., and Kuo, A.Y. Thermal Discharges: Prototype vs. Hydraulic Model. (See complete entry in Section VI.)

Pequegnat, W.W., Fay, R.R., and Wastler, T.A. Combined Field-Laboratory Method for Chronic Impact Detection in Marine Organisms and Its Application to Dredged Material Disposal. (See complete entry in Section V.)

Qasim, S.Z., and Gupta, R.S. Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa. (See complete entry in Section III.)

Ross, B.E., Anderson, M.W., and Jerkins, P. A Set of Coordinated Mathematical Models for the Coastal Zone. (See complete entry in Section VI.)

Sayers, D.R. Implications for the Quality Management of Estuaries and Coastal Waters. JOURNAL OF THE INSTITUTION OF WATER ENGINEERS AND SCIENTISTS, 34(2):145-160, March 1980.

The paper describes how pollution prevention legislation, which, for salt water, is confined principally to estuaries at present, will be modified and extended to cover all salt waters as far as the three-mile territorial limit by the implementation of the Control of Pollution Act 1974. Some comments are also offered on the practical implications for the Water Authorities of this extension to their pollution control function. References (10 items).

Schmidt, G.M. The Exchange of Water Between Prince William Sound and the Gulf of Alaska. (See complete entry in Section I.)

Sea Grant Publications Index 1979. (See complete entry in Section I.)

Sengupta, S., Lee, S.S, and Miller, H.P. Three-Dimensional Numerical Investigations of Tides and Wind-Induced Transport Processes in Biscayne Bay. (See complete entry in Section VI.)

Stephenson, R. Avon-Heathcote--Estuary Under Stress. SOIL & WATER, 16(2):22-25, April 1980.

The Avon-Heathcote Estuary is a small (6 km^2 in area) bar-built estuary, with a drainage basin of approximately 200 km^2. During the past 130 years, the City of Christchurch has grown around it--to the present population of approximately 300,000. Consequently, over 80 percent of the freshwater catchment is heavily urbanised. The effect that urban and industrial development around the estuary has had upon the estuarine ecosystem has been significant, and is the subject of this case study. The Avon-Heathcote Estuary has, in characteristic fashion, reflected the drastic alteration of its drainage basin by changes in its own physical, chemical, and biological characteristics. Changes in vegetation, drainage patterns, and land cover altered the nature and degree of flow characteristics and sedimentation. In addition, the domestic and industrial effluents discharged into the rivers and into the estuary proper have had far-reaching effects upon the kinds and numbers of plants and animals within the estuary. In parallel with these man-induced changes, there have been the naturally occurring, short-term changes in the configuration of the spit, the outlet channel, and the channels within the estuary--all characteristic of estuarine instability.

Stout, H.P. Prediction of Oxygen Deficits Associated with Effluent Inputs to the Rivers of the Forth Catchment. INSTITUTION OF CIVIL ENGINEERS, PROCEEDINGS, 67(Pt.2):51-64, March 1979.

The principal hydrological features of the five main rivers draining to the Forth estuary west of Queensferry are reviewed, and curves relating mean depth Z and mean velocity V to the flow per unit width Q/L are constructed from public data. The curves take the form $Z = G(Q/L)^m$ and $V = (Q/L)^{1-m}/G$ with m approximating to 0.5 and G being a numerical constant. Analytical solutions of appropriate one-dimensional diffusion equations can be used to obtain estimates of the order of magnitude of the oxygen deficit profiles resulting from continuous discharges to the rivers of biodegradable effluents, both carbonaceous and nitrogenous. Evaluation of these solutions requires information on the reaeration coefficient and the half life of the biodegradable material as well as Z, V and Q/L. The reaeration coefficient itself is obtained from an empirical equation involving G and Q/L. For single inputs of sustained oxygen demand loading, the maximum deficits generated, together with their location and residual oxygen demand, are calculated for each river. It appears that the time spent by effluent in the rivers before being discharged to the estuary is too short to achieve any significant reduction in oxygen demand. The main part of the biodegradation occurs in the estuary, and the input loadings to the rivers must be matched to the ability of the estuary to absorb these loads satisfactorily. The extent of this matching is examined for each river. References (6 items).

Stover, J.E., Huston, R.J., and Bergman, W.D. Mathematical Modeling of Thermal Discharge into Shallow Estuaries. (See complete entry in Section VI.)

Suszkowski, D.J., and Mansky, J.M. The Disposal of Sediments Dredged from New York Harbor. (See complete entry in Section V.)

Tamai, N. Friction at the Interface of Two-Layered Flows. (See complete entry in Section III.)

Taylor, D. The Effect of Discharges from Three Industrialized Estuaries on the Distribution of Heavy Metals in the Coastal Sediments of the North Sea. ESTUARINE AND COASTAL MARINE SCIENCE, 8(4):387-393, April 1979.

The distribution of eleven heavy metals in coastal sediments extending from the Scottish border to the Wash has been studied with the object of assessing the environmental impact of industrial wastes discharged into the highly developed estuaries of the Tyne, Tees, and Humber. The results indicate that the geology of the area can be a more important factor than the industrial input in deciding the metal content of marine sediments. References (9 items).

Thakar, V.S., and Bhandary, R.S. Two-Dimensional Mathematical Model of Circulation in Bombay Harbour. (See complete entry in Section VI.)

Ward, G.H., Jr. Hydrography and Circulation Processes of Gulf Estuaries. (See complete entry in Section I.)

West, J.R., and Broyd, T.W. Dispersion Coefficients in Estuaries. (See complete entry in Section III.)

Whitlock, C.H., et al. Laboratory and Field Measurements of Upwelled Radiance and Reflectance Spectra of Suspended James River Sediments near Hopewell, Virginia. (See complete entry in Section VII.)

Whittle, P.J., and Horne, M.W. Characterization of Oil Spills on Inland and Estuarine Waters. JOURNAL OF THE INSTITUTION OF WATER ENGINEERS AND SCIENTISTS, 34(1):50-60, January 1980.

Gas chromatographic and infrared techniques are now in routine use for the analysis of pollutant oils. The techniques are discussed in the paper, together with the thin-layer chromatographic identification of marker dyes; outstanding problems, particularly with regard to the analysis of lubricating oils, are also considered. References (2 items).

Wilson, R.E., and Okubo, A., Longitudinal Dispersion in a Partially Mixed Estuary. JOURNAL OF MARINE RESEARCH 36(3):427-447, August 1978.

Dye tracer experiments conducted in the York River estuary are presented. Concentrations of dye released instantaneously were monitored with the object of obtaining information on pollutant dispersion characteristics in a stratified estuary. Vertical mixing and vertical shear in the tide and nontidal currents cause the substance introduced to spread in the direction of flow. The study of longitudinal dispersion is based on the theoretical techniques and results of Okubo, with the exception that vertical advection is also included. A shear-diffusion model, describing the vertical distribution of concentration as a function of time, is presented and the asymptotic behavior of the first and second moments of the longitudinal distribution is demonstrated, also comparing the observed values with those predicted. Results of former dye experiment have been utilized to improve an existing model, quoting 13 references (basic papers of Harleman are missing). The clear explanation of the measurements and analysis enable the reader to perform similar studies. Specialists in estuary pollution will be particularly interested. References (13 items).

Wood, P.C., The Workings of the Control of Pollution Act in Tidal Waters: A View of the Ministry of Agriculture, Fisheries and Food. WATER POLLUTION CONTROL, 80(2):180-188, 1981.

The paper reviews the likely involvement of the Ministry of Agriculture, Fisheries and Food (MAFF) with the part of the Act related to tidal waters, and discusses some of the technical problems relevant to the MAFF which are likely to be encountered by the water authorities. References (4 items).

SECTION V. REGULATION AND IMPROVEMENT

Examples and histories of prototype improvements, types and locations of improvements, materials and designs of structures, construction practices, dredging, and the practical aspects of regulation and improvement for navigation, sedimentation, and contamination, and other purposes, as contrasted to the theoretical aspects.

Anthony, R.J. The Changing Tides on Tidal Power. (See complete entry in Section VII.)

April, G.C., Ng, S., and Brett, C.E. Sediment Transportation and Deposition Models for Mobile Bay, Alabama. (See complete entry in Section II.)

Barthel, V. Stability of Tidal Channels Dependent on River Improvement. (See complete entry in Section II.)

Barwis, J.H., Perry, F.C., and LaGarde, V.E. Computer-Aided Photo Studies of Inlet Stability. (See complete entry in Section II.)

Bastian, D.F. Salinity Effects of Deepening the Dredged Channels in the Chesapeake Bay. (See complete entry in Section III.)

Behrens, E.W. New Corpus Christi Pass, a Texas Tidal Inlet. (See complete entry in Section II.)

Behrens, E.W., and Watson, R.L. Corpus Christi Exchange Pass 1972-1976. (See complete entry in Section VIII.)

Behrens, E.W., Watson, R.L., and Mason, C. Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History 1972-1973. (See complete entry in Section II.)

Bella, D.A. Diagnosis of Chronic Impacts of Estuarine Dredging. JOURNAL OF ENVIRONMENTAL SYSTEMS, 9(4):289-311, 1979-80.

A method for identifying environmental impacts to estuarine sediments was developed and applied to Coos Bay, Oregon. This approach was directed toward early phases of environmental impact assessment and appears to be effective for promoting truly interdisciplinary efforts. Physical, chemical, and biological characteristics were sketched on a two-dimensional plot of organic content of the sediment versus rate of sediment turnover. These plots were overlayed to given common characteristics. Movements of stations on the plane were identified as chronic impacts.

Berger, R.C., Jr., and Boland, R.A., Jr. Mobile Bay Model Study, Report 2, Effects of Enlarged Navigation Channel on Tides, Currents, Salinities, and Dye Dispersion, Mobile Bay, Alabama; Hydraulic Model Investigation. (See complete entry in Section VI.)

Bohlen, W.F., Cundy, D.F., and Tramontano, J.M. Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations. ESTUARINE AND COASTAL MARINE SCIENCE, 9(6): 699-711, December 1979.

Field sampling of the suspended material field downstream of a large volume bucket dredge operating in the Lower Thames River estuary near New London, Connecticut, was conducted in order to examine the magnitude and character of the dredge-induced resuspension and to evaluate typical operational efficiency. These data indicate that approximately 1.5 to 3 percent of the sediment volume in each bucket-load is introduced into the water column producing suspended material concentrations adjacent to the dredge of 200 mg l^{-1} to 400 mg l^{-1}. These values exceed background levels by two orders of magnitude. Analysis of particulate organic carbon and grain size characteristics indicates that resuspension also alters suspended load composition increasing the percentage of inorganic materials and median grain size. Proceeding downstream, material concentrations along the center line of the dredge-induced plume decrease rapidly approaching background within approximately 700 m. Compositional variations display similar trends with the major perturbations confined to the area within 300 m of the dredge. The observed spatial distributions indicate the dredge-induced resuspension is primarily a near-field phenomenon producing relatively minor variations as compared to those caused by naturally occurring storm events. Previous work (Bohlen & Tramontano, 1977) has shown that these latter systems can produce estuary-wide variations in suspended material concentrations, increasing the mass of material in suspension by at least a factor of two. This increase in total suspended load is nearly an order of magnitude larger than that produced by the dredge. These field observations also show that there is a distinct physical similarity between dredge and storm-induced resuspension and provide some useful indications of the probable response of the larger scale coastal suspended material field to a variety of natural, high energy disturbances. References (11 items).

Bokuniewicz, H.J., et al. Field Study of the Effects of Storms on the Stability and Fate of Dredged Material in Subaqueous Disposal Areas. (See complete entry in Section II.)

Bonnefille, R. Present State of Knowledge: The Physical Behaviour of an Estuary and Its Implication on Estuary Dynamics. (See complete entry in Section I.)

Booda, L. Ocean Energy Challenges Technology; Grows. SEA TECHNOLOGY,19(8):10-14, 16-17, August 1978.

According to the US Department of Energy the ocean related energy possibilities are (i) ocean thermal energy conversion, (ii) ocean biomass, (iii) wave power, (iv) ocean currents, (v) offshore winds, (vi) tidal power, and (vii) salinity gradients. The paper provides a brief review.

Brahme, M.V., Vasudev, S.S., and Pavamani, F.S. Dutch Method of Reclamation--A Case Study for New Bombay. THE DOCK AND HARBOUR AUTHORITY, 61(721):252-254, December 1980.

In order to relieve the heavily congested city of Bombay, the City and Industrial Development Corporation of Maharashtra are developing an urban center at Washi, located some 26 km outside of Bombay. This site is below high tide level, and conventional methods of reclamation which entail filling the low-lying areas with suitable soil have prove exorbitantly expensive. The 442 ha area selected at Washi is separated from Bombay Island by the Thane Creek and is linked to Bombay city by the Thane Creek bridge which was opened in January 1972. This important link gave an added

impetus to the development of this area, a common feature being the several creeks criss-crossing one another and finally joining the Thane Creek. During high tide, the ingress of tidal water in these watercourses submerges about 332 ha of the tidal project area. Because of this, the low-lying area is generally marshy and covered with wild growth. The remaining area of 110 ha is made up of high grounds on which the local villages--Washi, Judu, and Turbhe--are situated. Prior to the construction of Thane Creek bridge, the only access to this area was from Thane side via the Thane-Belapur road. During the high tides, Washi and Juhu Villages were approachable only by the high bunds linking the villages to the Thane-Belapur Road. This article describes alternative reclamation schemes. The project feasibility study prepared for reclamation of Washi area is a typical application of the Dutch method of reclamation to Indican conditions. The study highlights how, in spite of inadequate data which is essential for a project of this kind, design parameters could be formulated, particularly the design rainstorm and maximum tidal variations, by establishing appropriate correlations. The study also highlights planning for formation of different polders taking advantage of the natural drainage pattern of the area to facilitate effective land use and stagewise construction.

Brogdon, N.J., Jr. Mayport-Mill Cove Model Study, Report 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. (See complete entry in Section VI.)

Bruun, P. Design of Tidal Inlets on Littoral Drift Shores. (See complete entry in Section II.)

Buckman, D. How France's Tidal Power Plant is Working Out. OCEAN INDUSTRY, 14(2):81-82.

A report is presented of the problems affecting the La Rance tidal power plant. Since its inception in 1961 and connection in 1966, it has been monitored continually for signs of wear and breakdown. Only a moderate amount of machinery downtime has been experienced, due to corrosion by seawater and electrical trouble with pump start-up. The advantages of the scheme are briefly mentioned including less dependence on imported fuel and the technology advances made possible for river bulb set (turbine) development.

Burwash, W.J., and Matich, M.A.J. Stage Loading of a Highway Embankment on Tidal Flats. CANADIAN GEOTECHNICAL JOURNAL, 18(4):535-542, November 1981.

The approach embankment to the eastern extremity of a bridge across the East River near Trenton, Nova Scotia, involved construction of a 6.4-m-high embankment on tidal flats. Very soft to soft slightly organic marine silts were found to underlie the tidal flats to a depth of 6-9 m where bedrock was encountered. Construction of an embankment of this height on the tidal flats would require very flat side slopes to ensure stability. Alternatively, all or part of the silt could be removed or the embankment could be built slowly using the stage loading technique and allow the silt to consolidate and gain strength during construction of the embankment. Stage loading had a considerable economic advantage over the other alternatives and since sufficient time was available, this method was adopted. The case history of this project is presented including results of the settlement performance of the embankment and porewater pressure response in the silt. These results are compared with predicted values, and conclusions are drawn regarding the stage loading technique for this particular type of application. References (8 items).

Butler, H.L. Numerical Simulation of Tidal Hydrodynamics, Great Egg Harbor and Corson Inlets, New Jersey. Technical Report H-78-11, US Army Engineer Waterways Experiment Station, Vicksburg, Miss., June 1978.

Great Egg Harbor Inlet and Corson Inlet, located in southeast New Jersey, have been plagued with hazardous navigation conditions and erosion problems. Numerical techniques were used to investigate the tidal hydrodynamics of the inlet complexes for existing conditions as well as for proposed improvement plans. The physical size and complex geometry of the study areas required a simulation model that could be economically applied. Consequently, an inherent part of the study involved development of a numerical model (WI model) based on an implicit finite difference formulation. The model includes treatment of moving boundaries and subgrid-scale barriers. A comparison study with a well-known explicit finite difference tidal model was performed to assure the implicit model's reliability and cost effectiveness. References (15 items).

Caccese, L.A., and Spies, H.R. Barnegat Inlet, Nature Prevails! Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 305-310.

"The improvement of an inlet on a sandy coast is one of the most difficult problems in harbor engineering and its cost and uncertainty is so great that it should only be attempted when necessary to improve the approach to some great port of commerce." This statement was made by Major C. W. Raymond in a report to the Chief of Engineers in August 1892 in a discussion on Barnegat Inlet. Major Raymond wisely acknowledged the limitations of coastal engineering in the 19th century. Are we showing similar wisdom and humility in this 20th century? We do not seem to be, for we have a number of coastal engineering projects constructed this century which do not provide intended results, and we seem to approach new coastal projects with the same inadequate knowledge which contributed to past failures. Barnegat Inlet is illustrative of one such project. Barnegat illustrates how nature can, and does, prevail over the best of our coastal engineering technology and the best of our efforts.

Callaway, R.J. Flushing Study of South Beach Marina, Oregon. (See complete entry in Section VI.)

Chatham, C.E. Los Angeles Harbor and Long Beach Harbor: Design of the Hydraulic Model. (See complete entry in Section VI.)

Chen, W.T., ed. Applications of Remote Sensing to the Chesapeake Bay; Volume 1, Executive Summary. (See complete entry in Section VII.)

Choudhury, T.K. Use of Unconventional Materials in the Construction of Nupur Spurs, River Hooghly. IRRIGATION AND POWER, 36(2): 181-186, April 1979.

This article deals with introduction of some new materials like concrete hexapods and properly designed bamboo cages, etc., as against use of only conventional materials like bricks and boulders in the construction of particularly the deep spurs under tidal conditions. The materials have been found suitable from the standpoints of economy, feasibility, and rapidity of construction as well as mobilization of local labor and equipment ensuring thereby employment benefit of a Project direct to local youth. The problem of completion of 4 long spurs in the Nurpur Reach, River Hooghly, could not be solved for 5 years because of development of big scour at the noses of the spurs when bricks were being used in the conventional way for the construction. The other limitation in mighty River Hooghly were the time limit for stabilization, high current, and occasional bore as well as lack of facility of mechanical equipment and communication in the remote riverbanks. It was necessary to complete the construction of a 73,000-cu-m spur in a period of 5 months with only 40 to 50 small dinghies working only for one cycle a day and local village labor as available in the area. The most pressing factor was that unless the construction was completed and stabilized within the 5 months time limit ending in mid-March, damage occurring in the ensuing dry period would be high enough causing very increased cost of ultimate construction. So materials have to be evolved which were to be cheap, locally available, and could cover a large volume for faster construction. It should also not get drifted by high current and at the same time be durable enough till the spur could be completed.

Cordes, F. The Effect of the Storm Barrier of the Eider River. In: Proceedings, Sixth International Harbour Congress, 12-18 May 1974, Antwerp, Belgium, 2.18/1-2.18/4.

In connection with improving the high tide water protection of the German North Sea coast the Eider River had to be dammed up at the coastline of the West coast of Schleswig-Holstein. The Eider River drains an area of 2,000 sq km with a backswamp area of 220,000 ha. The tide volume amounts to 42 million cu m. The storm barrier of the Eider River serves for the purpose controlling the tide, looking against storm tides, regulating the receiving water, and preventing for sand settlement. It has five openings with a clear span of 40 m each; the discharge is controlled by steel tainter gates. After an operating time of 1 year the following effects have been noticed: protection against storm tide, better dewatering of the backcountry, and no flooding because of perfect tide controlling. On both sides of the storm barrier the depth of the bottom has increased on a length of 1 km and to a maximum depth of 14 m. Even more improvement concerning the dewatering may be expected due to the favorable development of the riverbed.

Cundy, D.F., and Bohlen, W.F. A Numerical Simulation of the Dispersion of Sediments Suspended by Estuarine Dredging Operations. (See complete entry in Section VI.)

Czerniak, M.T. Inlet Interaction and Stability Theory Verification. (See complete entry in Section II.)

Davies, C.M. Evidence for the Formation and Age of a Commercial Sand Deposit in the Bristol Channel. (See complete entry in Section II.)

DeAlteris, J., McKinney, T., and Roney, J. Beach Haven and Little Egg Inlets, A Case Study. (See complete entry in Section II.)

Dean, R.G., and Perlin, M. Coastal Engineering Study of Ocean City Inlet, Maryland. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 520-542.

Ocean City Inlet, Maryland, provides safe refuge and passage for small fishing and pleasure craft from Sinepuxent and Isle of Wight Bays to the Atlantic Ocean. The authorized dimensions of the inlet channel are 10 ft deep by 200 ft wide; this channel extends to Commercial Fish Harbor. The purpose of the study described was to identify causes of and develop recommendations for reducing the requirement for increased frequencies and quantities of dredging in the westerly segment of the inlet channel. References (8 items).

DeGroot, A.J. and Salomons, W. Influence of Civil Engineering Projects on Water Quality in Deltaic Regions. (See complete entry in Section IV.)

DeLory, R.P. Integrating Fundy Tidal Power, WATER POWER AND DAM CONSTRUCTION, 31(9):37-39, September 1979.

The economic utilization of the energy output from the proposed Fundy tidal power project is discussed. The La Grande project in Quebec is one of the schemes interested in the possibility of transmitting surplus energy to neighboring systems, thus fully exploiting all the power produced.

Demarest, J.M., II, and Kraft, J.C. Protection of Sedimentation Patterns in Breakwater Harbor, Delaware. (See complete entry in Section II.)

Ecker, R.M., Sustar, J.F., and Harvey, W.T. Tracing Estuarine Sediments by Neutron Activation. (See complete entry in Section VII.)

numerical model of the northwest European shelf and compared with observational data from tide gauges and current meter rigs moored in different positions in the North Sea. The observed and computed current ellipse parameters (semimajor and semiminor axes, axis orientation, and sense of rotation) were tabulated and compared. An analysis of amplitude errors derived from computed and observed M_2 tidal elevations showed a marked difference in the distribution of phase errors, as derived, on the one hand, from the present 3-dimensional model and, on the other hand, from an earlier 2-dimensional model covering the same region. References (14 items).

Davis, J.M. The Finite Element Method: An Alternative Subdomain Method for Modelling Unsteady Flow in Coastal Waters and Lakes. In: Proceedings, International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle-Upon-Tyne, England, April 12-15, 1976, B4-41-B4-53.

The vertically integrated equations defining wave propagation in shallow water form the basis of a Galerkin finite element model suitable for application to two-dimensional tidal flow in coastal areas, and wind induced currents in shallow lakes. The velocities, which are uniform over the depth, together with the displacement of the free surface, can be determined through time. The model includes a general definition for free-slip velocity conditions on fixed boundaries, and has been applied to the tidal propagation in the Southern North Sea and to the wind induced currents in circular lake of constant depth. References (8 items).

DeAlteris, J., McKinney, T., and Roney, J. Beach Haven and Little Egg Inlets, A Case Study. (See complete entry in Section II.)

De Grandpre, C.D.B, El-Sabh, M.I., and Salamon, J.C. A Two-Dimensional Numerical Model of the Vertical Circulation of Tides in the St. Lawrence Estuary. ESTUARINE, COASTAL SHELF SCIENCE, 12(4):375-387, April 1981.

A two-dimensional numerical model is used to study the vertical circulation of tides in the St. Lawrence estuary. The governing equations, which express the conservation of volume, momentum, and salt content are solved by a finite difference initial-value method. This model permits the calculation in real time of the water height, vertical and longitudinal salinity, and velocity distributions. The only data required for the application of this model are the topographical data of the estuary, the relevant tidal heights, and measurements of salinity at the estuary mouth and landward boundaries. The model was tested by adjusting the friction and turbulence coefficients. Comparison of the model results with actual measurements shows that the model can provide a realistic reproduction of the vertical instantaneous circulation. In addition, the model permits the simulation of the internal tides which have been observed in the St. Lawrence estuary. References (20 items).

De Vries, M. Modelling of Sediment Transport: Link in a Chain. (See complete entry in Section II.)

Dierckx, P., et al. A New Method of Cubature Using Spline Functions. (See complete entry in Section I.)

Downing, J.P., Jr. Particle Counter for Sediment Transport Studies. (See complete entry in Section II.)

Dronkers, J.J. Some Practical Aspects of Tidal Computations. In: Proceedings, 13th International Association for Hydraulic Research Congress, Kyoto, Japan, 3:11-20, 1969.

Several practical aspects of estuarine modeling are discussed. Included are use of one- or two-dimensional models in the transition area between river and sea; use of explicit or implicit finite-difference schemes, and grid and time step relations; practical aspects of boundary conditions; density variations due to salinity intrusion; and tidal-movement forces. References (7 items).

Dvoryaninov, G.S. Theoretical Model of Mass Transport By Gravity and Tidal Waves. (See complete entry in Section I.)

Dyer, K.R. Lateral Circulation Effects in Estuaries. (See complete entry in Section I.)

Dyke, P.P.G. On the Stokes' Drift Induced by Tidal Motions in a Wide Estuary. (See complete entry in Section I.)

Edge, B.L., O'Brien, J.F., and McCoy, J.E. Methodology for Siting Power Plants on Industrialized Estuaries. (See complete entry in Section IV.)

Edinger, J.E., and Buchak, E.M. Numerical Hydrodynamics of Estuaries. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 115-146, 1980.

Classically, estuaries have been classified dimensionally on the basis of the dominant salinity gradients. Following Pritchard (1958) the general classifications based on spatial averaging of the constituent transport relationship are: (1) three-dimensional; (2) laterally homogeneous with longitudinal and vertical spatial gradients dominant; (3) vertically homogeneous with longitudinal and lateral spatial gradients dominant, and (4) sectionally homogeneous with longitudinal gradients dominant. Development of the hydrodynamic (momentum transport) relationships follow similar spatial averaging and classification. In general, the momentum balances determine the flow field by which the constituent is transported. The momentum and constituent transport are interrelated in estuaries through the horizontal density gradient as determined from the constituent distribution. Only the fourth case, sectional homogeneity, is solvable for a few limiting situations without use of the hydrodynamic relationships, and are situations for which the advective flow field can be inferred from fresh water inflow. References (28 items).

Escoffier, F.F., and Walton, T.L., Jr. Inlet Stability Solutions for Tributary Inflow. (See complete entry in Section I.)

A finite element model is developed for the numerical prediction of the dispersion process in a strongly stratified water body idealized as a two-layer system. The physical processes of mixing through the density interface and horizontal dispersion are discussed. Numerical integration in time is based on an implicit iterative trapezoidal scheme. Results for one-dimensional counterflow conditions are verified with analytical solutions. Finally, the model is applied to a large dispersion experiment in Massachusetts Bay. References (19 items).

Chu, W-S., and Yeh, W.W-G. Two-Dimensional Tidally Averaged Estuarine Model. Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY4):501-518, April 1980.

The governing equations are the hydrodynamics equations coupled with the transport equation. The effect of the density gradient is included in the model which requires simultaneous solutions for all variables. The tidally averaged solutions and the associated numerical scheme are verified by solutions obtained from a corresponding transient model where long-term integration is performed to reach a dynamic steady-state condition. The proposed model can be utilized to: (1) obtain dynamic steady-state solutions directly without performing long-term integrations over time; and (2) serve as an efficient forward solution scheme for parameter identification, since parameters imbedded in the governing equations, such as the roughness coefficients, are essentially time-invariant. The tidally averaged model is derived under the assumption that amplitudes of the transient variables are small in magnitudes. References (25 items).

Clark, L.J., Ambrose, R.B., Jr., and Crain, R.C. A Water Quality Modelling Study of the Delaware Estuary. Philadelphia, US Environmental Protection Agency, Middle Atlantic Region III, EPA 903/9-78-001, January 1978.

Recent data acquisition, analysis, and mathematical modelling studies were undertaken to improve the understanding of water quality interactions, particularly as they impact DO, in the Delaware Estuary. A version of the Dynamic Estuary Model, after undergoing considerable modification, was applied in an iterative process of hypothesis formation and testing. Both model parameters and model structure were updated and improved through this process until five intensive data sets gathered in the estuary between 1968 and 1976 were satisfactorily simulated. References (23 items).

Costa, S.L., and Isaacs, J.D. The Modifications of Sand Transport in Tidal Inlets. (See complete entry in Section II.)

Cundy, D.F., and Bohlen, W.F. A Numerical Simulation of the Dispersion of Sediments Suspended by Estuarine Dredging Operations. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 339-353, 1980.

A predictive numerical model designed to simulate the dispersion of sediments suspended by estuarine clamshell dredging operations is described. The model evaluates the downstream distribution of the column of materials introduced by each vertical pass of the dredge bucket using a modified conservation of mass approach in which a horizontal moment term is used to represent the spatial distribution of the suspended mass concentrations. Solution of the resultant equation in finite difference form provides a time history of the 0th to 4th moments of the dispersing mass introduced by each bucket pass. A representation of the sum total effect of these discrete injections forming the downstream plume is then developed through linear superposition. This scheme provides a description of the gross characteristics of the dispersing mass without requiring large amounts of computer time and storage. Required inputs to the model include specification of the local mean velocity characteristics, sediment settling velocities, and turbulent mass diffusion coefficients. Field data obtained under a variety of conditions are used to supply these inputs and to test the accuracy of the computational scheme. Preliminary comparisons suggest that this model provides a reasonable analogue of observed field conditions. Accuracy appears to be primarily dependent on the specification of settling velocity and mass diffusivity representing second-order influences. References (14 items).

Davies, A.M., and Flather, R.A. Computation of the Storm Surge of 1 to 6 April 1973 Using Numerical Models of the North West European Continental Shelf and the North Sea. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 30(5):139-162, 1977.

The storm surge period 1 to 6 April 1973 is computed using two numerical models. One of coarser resolution covers the whole North West European continental shelf, the other has a finer resolution and covers the North Sea only, including the Skagerrak and Kattegat. A comparison of the surge computed by these models with and without the tide (consisting of the M_2 and S_2 components) enables the effect of tide/surge interaction in each model to be examined. Effects produced by changes in model resolution may also be studied. Results obtained from North Sea model, using the hydrostatic law of pressure to determine surge levels on the open boundary are in good agreement with observations when the major contribution to the surge is generated within the North Sea. However, the use of this boundary condition leads to an error in the magnitude of the computed North Sea surge when the disturbance is generated externally. It is demonstrated that when surge residuals computed by the shelf model (together with observed residuals) from Wick) are used as input along the northern boundary of the North Sea model, the error in the computed surge arising from the use of the hydrostatic law along this boundary is reduced. Referemces (18 items).

Davies, A.M., and Furnes, G.K. Observed and Computed M_2 Tidal Currents in the North Sea. JOURNAL OF PHYSICAL OCEANOGRAPHY, 10(2):237-257, February 1980.

M_2 tidal elevations and currents were computed using a 3-dimensional hydrodynamic

Butler, H.L., et al. Lake Pontchartrain and Vicinity Hurricane Protection Plan; Report 2, Physical and Numerical Model Investigation of Control Structures and the Seabrook Lock; Hydraulic and Mathematical Model Investigation. Technical Report HL-82-2, US Army Engineer Waterways Experiment Station, Vicksburg, Miss., June 1982.

This report presents results pertinent to a detailed investigation of the three major arteries leading into the lake, namely, The Rigolets, Chef Menteur Pass, and the Inner Harbor Navigation Canal. The basic approach to simulating these passes and impact of structural alterations on the Lake Pontchartrain tidal prism can be outlined as follows: (a) Perform separate experiments with an undistorted hydraulic model of each pass with and without the proposed structure installed under steady-state conditions to quantify the hydraulic characteristics of each barrier. This is accomplished by measuring head losses across a structure for a range of water levels on the gulf side of the barrier and various flow rates. (b) Perform similar experiments with sectional numerical models (subgrids of the computational grid for the full three-lake system). The barrier effect is simulated by locally introducing the proper sill depth and by locally adjusting the flow resistance. (c) Perform similar experiments with finer scale sectional models to ensure that the computational grid resolution is adequate and that finer scale models are capable of describing the flow regime in the neighborhood of the proposed structures. References (6 items).

Callaway, R.J. Flushing Study of South Beach Marina, Oregon. Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings, ASCE, 107(WW2):47-58, May 1981.

A newly constructed single-opening marina was evaluated to determine flushing characteristics by comparison of a hydraulic model and a mathematical model with field studies of dye releases. Both models simulated well-mixed conditions and agreed well with each other. The dye study was conducted by mixing rhodamine-wt throughout the marina on a flood tide and monitoring dye concentration versus time over several tidal cycles following release. Over the initial 7-10 hr of the field studies, all three methods agreed well; field results thereafter showed three to six times less dye than model predictions. For marinas of simple geometry with single openings and width-to-length ratios similar to the marina studied here, flushing estimates may be conservatively approximated by elementary mathematical methods. References (23 items).

Campbell, J.W., and Thomas, J.P., eds. Chesapeake Bay Plume Study: Superflux 1980. (See complete entry in Section VII.)

Cartwright, D.E., et al. On the St. Kilda Shelf Tidal Regime. (See complete entry in Section VIII.)

Chapra, S.C., and Gordimer, S. Documentation of ES0001; a Steady-State, One-Dimensional, Estuarine Water Quality Model: New York, US Environmental Protection Agency, 1973, 224p.

A computer program to model tidally averaged one-dimensional steady-state systems for a variety of substance concentrations is described and documented. The model is specifically made for biological oxygen demand-dissolved-oxygen deficit systems but may be altered for any sequential reaction of two substances. References (11 items).

Chatham, C.E. Los Angeles Harbor and Long Beach Harbor: Design of the Hydraulic Model. In: Ports '77, 4th Annual Symposium of the Waterways, Port, Coastal and Ocean Division of ASCE, New York, ASCE, 1977, 47-64.

This paper decribes the design of a hydraulic model and related equipment constructed to experimentally investigate the effects of proposed expansions of Los Angeles and Long Beach Harbors. In order to ensure proper reproduction of waves in the model, it was necessary to conduct an extensive study of: (i) Wave refraction for wave periods of 15 sec to 6 min; (ii) Energy transmission through the breakwaters; (iii) Diffraction through the harbor entrances; (iv) Reflection from the offshore topography and from harbor boundaries; (v) Wave filters and absorbers; (vi) Model wave-height attenuation; (vii) Wave generators; (viii) Model data acquisition and analyses. It was concluded that valid data could be obtained from the model for a vertical scale of 1:100 and a horizontal scale of 1:400. Tides are mechanically reproduced by exchanging water between the model headbay and a water storage sump by means of a system of pumps, valves, and pipes. Waves are generated by a 210-ft-long electrohydraulic wave generator composed of 14 individual sections which can be positioned to reproduce curved wave fronts and controlled by automation techniques to generate waves of variable heights and periods. References (18 items).

Chiang, W.-L., and Lee, J.-J. Simulation of Large-Scale Circulation in Harbors. Journal of the Waterway, Port, Coastal, and Ocean Division, Proceedings, ASCE, 108(WW1):17-31, February 1982.

A numerical model capable of simulating vertically integrated tidal circulations in a harbor area for a long period of time has been applied to the Los Angeles-Long Beach Harbor. The computed results show that the large gyre structures, which have also been observed in the field, correlate closely with those found in a hydraulic model. In the difference equations, the nonlinear advective terms and the local acceleration terms are arranged on the same time level in order to improve the numerical stability. The numerical scheme is efficient for the hydrodynamic computation of tidal motion in a complicated harbor geometry. References (7 items).

Chopra, K.P. Thermally-Induced Air and Water Circulations in Estuarine Rivers. (See complete entry in Section I.)

Christodoulou, G.C., and Connor, J.J. Dispersion in Two-Layer Stratified Water Bodies. Journal of the Hydraulics Divsion, Proceedings, ASCE, 106(HY4):557-573, April 1980.

Experience with the Rotterdamse Waterweg model shows the importance of an automated model operation and control and the availability of adequate boundary conditions from nature. A very good reproduction of tidal propagation, flow field, and density distribution was possible. The model has been useful in providing support for management decisions related to the development of the estuary. References (13 items).

Brocard, D.N., and Hsu, S.-K. Mathematical Modeling of Heated Surface Discharge in Confined Tidal Estuary: Mercer Generating Station. (See complete entry in Section IV.)

Brocard, D.N., Hsu, S.-K., and Walker, C. Mathematical Modeling of Heated Surface Discharge in Confined Tidal Estuary, Ravenwood Generating Station. (See complete entry in Section IV.)

Brockmann, C., et al. The Tidal Stream in the German Bight. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 34(2):56-60, August 1981.

Current measurements from the German Bight during the last two decades are used to compare with results of a numerical model. The model is three-dimensional with four layers in the German Bight, and two-dimensional in the coupled adjacent North Sea part. For this study, ten partial tides are prescribed as driving force along the open boundaries in the Channel at about 4°W and in the North Sea at about 59°N. The tidal stream vectors resulting from the model and from the measurements, respectively, are compared at hourly intervals from -6 hours to +6 hours relative to high water in Helgoland for spring conditions. The model currents compare well with the observed tidal streams in areas with water depths greater than 10 m. In shallower regions local topographic influences upon the tidal stream lead to greater differences between measurements and model results, especially during times of weak tidal currents. It is expected that a higher resolving model will solve these problems in the near future. References (4 items).

Brogdon, N.J., Jr. Mayport-Mill Cove Model Study, Report 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. Technical Report HL-79-12, US Army Engineer Waterways Experiment Station, Vicksburg, Miss., July 1979.

A fixed-bed model of Mayport-Mill Cove, constructed to scales of 1:500 horizontally and 1:50 vertically, reproduced a portion of the Atlantic Ocean adjacent to the entrance and the St. Johns River upstream to Hibernia Point. The purpose of the model study was twofold: (a) to investigate the effects of proposed improvement plans for the Mayport Naval Basin area on existing shoaling rates, hydraulics, salinities, and flushing; and (b) to investigate the effects of proposed improvement plans in the Mill Cove area on flushing, hydraulics, salinities, and channel shoaling. The model study was conducted in three phases: phase 1 involved the model verification tests, phase 2 involved the Mayport Naval Basin Study, and phase 3 involved the Mill Cove study. Phase 1 is reported herein; phases 2 and 3 will be reported in Reports 2 and 3 of this series. The model verification tests described herein indicated that the model hydraulic and salinity regimes were in satisfactory agreement with those of the prototype for comparable conditions. Model verification also included a comprehensive shoaling verification of shoaling rates and patterns in the navigation channel and Mayport Naval Basin. During the shoaling verification, model operation procedures were developed by trial and error to achieve satisfactory reproduction of observed prototype shoaling distribution patterns within the various reaches of the navigation channel and in Mayport Basin. This report contains the results of tests conducted for phase 1 of the study.

Brown, R.D. Validation of Ocean Tide Models from Satellite Altimetry; Interim Progress Report, May-October 1978. (See complete entry in Section VII.)

Butler, H.L. Evolution of a Numerical Model for Simulating Long-Period Wave Behavior in Ocean-Estuarine Systems. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 147-182.

Numerical modeling of water-wave behavior has progressed rapidly in the last several years and is now generally recognized as a useful tool capable of providing solutions to many coastal engineering problems. This paper discusses the evolution of a numerical hydrodynamic model including its applications to a variety of problems in which long-wave theory is valid. To achieve a solution to the governing equations, finite difference techniques are employed on a stretched rectilinear grid system. The most recent version of the model permits a selection of solution schemes. Choices include both implicit and explicit formulations written in terms of velocity or transport dependent variables. The model predicts vertically integrated flow patterns as well as the distribution of water-surface elevations. Code features include the treatment of regions which are inundated during a part of the computational cycle, subgrid barrier effects, variable grid, and a variety of permissible boundary conditions and external forcing functions. Reproduction of secondary flow effects is an important aspect for a hydrodynamic model. Discussion of methods which are appropriate for treating the nonlinear terms in the governing equations (terms which cause secondary flow effects) is given. Direction of future code developments also is discussed. Applicability of the numerical model is demonstrated through a presentation of various ocean-estuarine system problems for which the model was applied. These include simulations of tidal circulation as well as coastal flooding from hurricane surges and tsunami waves. References (27 items).

Butler, H.L. Numerical Simulation of Tidal Hydrodynamics, Great Egg Harbor and Corson Inlets, New Jersey. (See complete entry in Section V.)

Bella, D.A., and Williamson, K.J. Simulation of *Sulfur Cycle in Estuarine Sediments.* Journal of Environmental Engineering Division, Proceedings, ASCE, 106(EE1):125-143, February 1980.

A mathematical model of estuarine sediment is developed using rate coefficients and field measurements. The model has a particular emphasis on the sulfur cycle and includes specific chemical components of dissolved oxygen, soluble organic carbon, sulfates, free sulfides, total sulfides, sulfide capacity, sulfur, and pyrite. Different levels of sediment organics (OCS) and turnover rates (RST) are mathematically imposed and the subsequent levels of chemical components are determined after a 210-day period. General chemical properties are identified for an RST-OCS plane. References (21 items).

Beltrami, E., and Carroll, T.O. A Land-Use Planning Model for Coastal Zone Management. (See complete entry in Section IV.)

Bennett, J.P. Calibration of Branched Estuary Models. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3416-3434.

Calibration of a stage-stage model requires the use of observed discharge. The best time for making the required discharge measurements is near the peaks of maximum and minimum downstream flow. Like variations in the Chezy discharge coefficient, errors in cross-sectional area cannot be detected using auxiliary stage observation stations. On the other hand, gauge datum discrepancies on the order of 0.05 ft and timing errors in one of the driving stage records on the order of 6 to 12 min can be detected by comparing the predicted and observed stage records from such stations. In most water quality modelling situations, discharge-stage models can be satisfactorily calibrated using only stage observations. The data used should cover as nearly as possible the range of mean flow discharges to be encountered in prediction. References (5 items).

Berger, R.C., Jr., and Boland, R.A., Jr. Mobile Bay Model Study, Report 2, Effects of Enlarged Navigation Channel on Tides, Currents, Salinities, and Dye Dispersion, Mobile Bay, Alabama; Hydraulic Model Investigation. Technical Report H-75-13, Report 2, US Army Engineer Waterways Experiment Station, Vicksburg, Miss., March 1979.

This report is the second in a series of reports on the results of model tests on the Mobile Bay model. Report 1 covers the verification anf effects of proposed Theodore Ship Channel and Disposal Areas on tides, currents, salinities, and dye dispersion. Model tests in this report (Report 2) were chiefly designed to determine the impact of widening and deepening of the navigation channels and the accompanying dredged material disposal islands on tides, currents, salinities, and dye-dispersion patterns in Mobile Bay. The test results consist of comparable measurements of tide heights, current velocities, salinities, and dye-dispersion patterns for existing and proposed conditions. There was very little change in the tide heights in the bay for any plan. In general, for all plans an increase in maximum velocity occurred at stations in the low-velocity regions (the central region of the channel) and essentially, no change or a slight reduction in maximum velocity occurred at stations in the high-velocity regions (the upper and lower reaches). Enlargement of the channel seemed to be the dominant cause of salinity changes in the bay. All the plans generally raised the average salinity of the upper (north) bay and lowered the average salinity in the lower (south) bay. No plan maintained status quo (change at 0.5 ppt or less) in all four critical oyster-bed areas for area-average salinity or average bottom salinity.

Blackford, B.L. On the Generation of Internal Waves by Tidal Flow over a Sill: A Possible Nonlinear Mechanism. (See complete entry in Section I.)

Blair, C.M. Mass Transfer Verifications of Tidal Froude Models. Journal of the Hydraulics Division, Proceedings, ASCE, 105(HY12):1561-1564, December 1979.

Hydraulic models are of limited value unless they have been "verified," i.e., unless pertinent model and prototype parameters have been compared and found to be in agreement. If such agreement exists, the model is said to have achieved similitude. This paper summarizes the writers' findings and other published research concerning the existence of similitude of mass transfer in tidal Froude models. References (19 items).

Blumberg, A.F. On the Dynamic Balance of the Chesapeake Bay Waters, CHESAPEAKE SCIENCE, 18(3):319-323, 1977.

A previously developed two-dimensional numerical model is used to evaluate simplifications sometimes used in modelling. Coriolis terms and advective terms were neglected in separate simulations, and the bottom friction coefficient was varied in two runs. All modifications produced major changes in both the predicted tidal dynamics and circulation patterns, when compared to previous, all-inclusive data. References (5 items).

Bonnefille, R. Modeling in Coastal Engineering. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Seminar No. 1, 1973.

Three types of hydrological scale models currently used in civil engineering practice are discussed. The types of models covered are: fixed bottom, both tidal and wave; sedimentological of movable beds; and structural. The purpose and use of each type of model are also given.

Breusers, H.N.C., and Van Os, A.G. Physical Modeling of Rotterdamse Waterweg Estuary. Journal of the Hydraulics Division, Proceedings, ASCE, 107(HY11):1351-1370, November 1981.

Hydraulic scale models are still the most powerful tools in studying estuarine problems (density flows and salinity intrusion). Weak points are, however, uncertainties in the scaling laws for vertical mixing of salt and momentum and in the boundary conditions.

Abbott, M.B. The Application of Design Systems to Problems of Unsteady Flow in Open Channels. (See complete entry in Section I.)

An, H.S. A Numerical Experiment of the N(2) Tide in the Yellow Sea. JOURNAL OF THE OCEANOGRAPHICAL SOCIETY OF JAPAN, 33:103-110, 1977.

Semidiurnal tides in the Yellow Sea are calculated by integrating the shallow water wave equations with frictional and inertial terms. It is found that the results depend on the bottom friction. In the frictionless case the tidal range is unstably amplified because of the occurrence of resonance of the semidiurnal tidal component in Inchon Bay. When the bottom friction is in the form of the square of velocity, the results agree fairly well with the observations. References (14 items).

Anwar, H.O. A Study of the Turbulent Structure in a Tidal Flow. (See complete entry in Section I.)

Anwar, H.O., and Atkins, R. Turbulence Measurements in Simulated Tidal Flow. (See complete entry in Section I.)

Anwar, H.O., and Weller, J.A. An Experimental Study of the Structure of a Fresh-Saltwater Interfacial Mixing. (See complete entry in Section III.)

April, G.C., and Raney, D.C. Predicting the Effects of Storm Surges and Abnormal River Flow on Flooding and Water Movement in Mobile Bay, Alabama. (See complete entry in Section III.)

April, G.C., Ng, S., and Brett, C.E. Sediment Transportation and Deposition Models for Mobile Bay, Alabama. (See complete entry in Section II.)

Backhaus, J. First Results of a Three-Dimensional Model on the Dynamics in the German Bight. In: Marine Forecasting, Predictability and Modelling in Ocean Hydrodynamics, Proceedings of the 10th International Liege Colloquium on Ocean Hydrodynamics, 1978, Nihoul, J.C.J. (ed.). Amsterdam, Elsevier, 1979, Elsevier Oceanographic Series 25, 333-349.

A three-dimensional barotropic fine mesh model of a shallow coastal sea is described. The tidal dynamics in a very shallow water, e.g. wetting and drying of mud flats, are simulated by means of a movable horizontal boundary. A critical examination of the model results, especially of the vertical current structure, is carried out. References (8 items).

Basco, D.R. On Numerical Accuracy in Computational Hydraulics. In: Proceedings, 25th Annual Hydraulics Division Specialty Conference on Hydraulics in the Coastal Zone, New York, ASCE, 1977, 179-186.

Finite-difference methods remain a popular and powerful technique to numerically solve the fundamental flow equations of hydraulics on the computer. Because all numerical methods are approximations, the question of relative inaccuracies resulting from the machine computations must be considered. Fortunately, theoretical methods do exist to estimate the amplitude and phase errors that occur in the propagation problems of engineering concern, e.g. river flood routing, tidal hydraulics, etc. The purposes of this paper are to: (i) review these methods; (ii) show how the calculations can be readily made for any finite-difference scheme; and (iii) discuss their implications when applied to engineering and research problems. References (10 items).

Basco, D.R. Sources of Computer Programs in Hydraulics. JOURNAL OF THE HYDRAULICS DIVISION, Proceedings, ASCE, 106(HY5):915-922, May 1980.

As one of its duties, the Task Committee on Computational Hydraulics, Hydraulics Division, ASCE, has compiled a list of bibliographies and publications that list the availability of various mathematical, numerical, and computer models for general use by hydraulic engineers. The compilation covers several major areas such as hydraulics, hydrology, ground water, surface water, water-resources management, unsteady flow, estuaries, and so forth. Most of the entries are described by essential information such as author(s), editor(s), or personnel to contact, year of publication or compilation, title, publishing journal or issuing organization, number of pages, number of references, programs or models listed, author affiliation, project sponsor, and notes that summarize any other pertinent and helpful information. It is hoped that the material included in the list will aid potential model users in finding suitable bibliographies, contacting key personnel, and accessing appropriate computing facilities.

Bastian, D.F. Salinity Effects of Deepening the Dredged Channels in the Chesapeake Bay. (See complete entry in Section III.)

Battelle Pacific Northwest Laboratories. Development of a Mathematical Water Quality Model for Grays Harbour and the Chehalis River, Washington. Richland, Wash., October 1974. 67p.

The objective of this study was to develop and apply a water quality model of the Grays Harbor Estuary and the Chehalis River. To accomplish this objective, the Battelle-Northwest water quality models EXPLORE-1 (for tidally influenced systems) and PIONEER-1 (for nontidal systems) were modified and calibrated to fit these specific situations. In this report, combined models simulate concentrations of water quality parameters. References (10 items).

Beauchamp, C.H., and Spaulding, M.L. Tidal Circulation in Coastal Seas. (See complete entry in Section I.)

Bell, P.R., et al. Measurement and Analysis of the Effects of Stormwater on the Lane Cove Estuary. (See complete entry in Section IV.)

Bella, D.A. Diagnosis of Chronic Impacts of Estuarine Dredging. (See complete entry in Section V.)

SECTION VI. MODELING AND OTHER LABORATORY EXPERIMENTS

Physical and mathematical model studies and other controlled experiments connected with any phase of tidal hydraulics. Investigations of theoretical aspects, studies for improvement or regulation at specific localities, theory of physical model design and operation, physical model appurtenances, and types of problems susceptible of model analysis.

Wave and Tidal Energy. (See complete entry in Section VI.)

Winton, T.C. Long and Short Term Stability of Small Inlets. (See complete entry in Section II.)

Young, R.M., and Ackers, P. Field Tests of Rip-Rap Slope Protection in a Shallow Coastal Area. (See complete entry in Section VIII.)

Engineers, was initiated at the Waterways Experiment Station. The purpose of this program is to develop improved techniques for bypassing sand at inlets and other obstructions to littoral drift. The program and its progress to 1975 were described in detail in Reference 2. Since that time, the research program has been developed to the point where its results can be used to expand and restructure the framework of available sand bypassing systems. The purpose of this paper is to present a current outline of this new framework. References (7 items).

Rohde, H. Sand Movement Investigations by Means of Radioactive Tracers in a Hydraulic Model and in the Field. (See complete entry in Section II.)

Sagar, B.T.A., and Frey, J. Tidal Gates. In: Proceedings of the Seventeenth Congress of the International Association for Hydraulic Research, August 15-19, 1977, Baden-Baden, Federal Republic of Germany, 4(Subj.C):181-188.

Tide gates are utilized to dispose of flood waters from inland regions and also to prevent entry of sea waters into the inland areas during tides. Counterweighted type flap gates are frequently used in coastal structures as these have the advantage of being automatically operated by the energy created due to differential heads between sea water and inland waters. This paper discusses the various forces on counterweighted tide gates and develops generalized formulae for use in flood routing programs. References (2 items).

Sea Grant Publications Index 1979. (See complete entry in Section I.)

Severn Tidal Power. Hydraulics Research Station, Wallingford, Oxfordshire, OX10 8BA, England, 1981.

The prospect of extracting power from the enormous tides of the Severn Estuary has attracted civil engineers for decades. Various schemes have been proposed over the years, studied to differing extents and shelved, generally for economic reasons. With world energy prices on a seemingly endless climb and with growing concern about the finite extent of nonrenewable energy sources, several countries have independently investigated the potential for tidal power. Encouraged by the successful development of a tidal power plant in the Rance Estuary (France), the Governments of Canada, India, and South Korea have begun or have completed feasibility studies. In the United Kingdom, the Department of Engergy commissioned prefeasibility studies during 1978 to 1981 to examine the wide range of engineering, environmental, and economic implications of a tidal power scheme for the Severn Estuary. As part of these studies, the Hydraulics Research Station (HRS) undertook a program of field, desk, and model investigations to assess the impact of a tidal power barrage on the hydraulics of the estuary. This publication is a brief account of the research commissioned at HRS by the Department of Energy and includes water movements, sediment transport, collection of field data, silt monitoring, properties of Severn Estuary mud, measurement of wave climate, and hindcasting extreme waves. References (25 items).

Shemdin, O.H., et al. Comprehensive Monitoring of a Beach Restoration Project. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1477-1492.

This paper outlines the results obtained from monitoring the Beach Nourishment Project at Jupiter Island, Florida. Jupiter Island is a 16-mile-long barrier island on the east coast of Florida. Five miles of the beach were nourished in two stages in 1973 and 1974. A total of 3.4 million cubic yards of sand were dredged from an offshore borrow area and placed on the beach. The monitoring program included: seasonal hydrographic surveys of beach and offshore profile to 3,000 feet offshore; climatological monitoring of wind, waves, tides, and currents over a one-year period; tracer and dye studies; and sand sampling and coring at selected beach and offshore locations. The results indicate that beach restoration has a groin effect in the sense of producing favorable changes in littoral drift due to shore alignment changes. A net accretion updrift of the restored area occurs. The results demonstrate the importance of the offshore profile in accounting for the total sedimentary balance. Shoreline recession coupled by a buildup in the offshore profile may reflect accretion rather than erosion. Finally, the results show that the littoral drift formula using the wave climate as input provides inadequate prediction estimates for erosion or deposition following construction of a beach restoration project. References (10 items).

Suszkowski, D.J., and Mansky, J.M. The Disposal of Sediments Dredged from New York Harbor. In: Proceedings of the 6th US/Japan Meeting on Management of Bottom Sediments Containing Toxic Substances, Toyko, Japan, 16-18, February 1981, 220-238.

New York Harbor is the leading port in the United States. Its continued viability depends upon the ability to maintain its channels and berthing areas through dredging operations. Because of many issues, primarily the fact that harbor sediments are contaminated with a wide range of pollutants from wastewater discharges and ocean disposal has been the primary disposal option, dredging operations have encountered problems. Biological test results indicate that New York Harbor sediments are relatively nontoxic. In addition, the majority of sediments tested do not appear to have a strong bioaccumulation potential for harmful contaminants. All feasible disposal options are being pursued in an integrated and cooperative approach. Emphasis has been placed on identifying disposal options for contaminated sediments. References (15 items).

Trawle, M.J. Georgetown Harbor, South Carolina, Report No. 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. (See complete entry in Section VI.)

Vollmers, H. Tidal Models with Movable Beds. (See complete entry in Section VI.)

not known, but it is suspected that repeated exposures may result in ecosystem changes equally as important as those caused by more easily determinable acute effects. Such considerations are particularly important to the aquatic environment, where dumped pollutants may be quickly diluted to legal nonlethal concentrations, but may still bring forth cumulative chronic response patterns. References (14 items).

Permanent International Association of Navigation Congresses. Improvement and Maintenance of Navigation Channels and Control of the Regime in Estuaries in Relation to the Energy Due to Tidal Movement, Waves and Swell at the Entrance. Proceedings, 24th International Navigation Congress, Section II, Ocean Navigation, Subject 2, Leningrad, 1977. 200p.

Contents: (1) The Control of Wave Action by Configuration Dredging at the Entrance to Botany Bay, Sydney, Australia, by J. M. Wallace. (2) Untitled paper in French by Jean-Michel Barbier. (3) Investigations on Model in Connection with Structural Measures on German Tidal Rivers by Hermann Harten and Hans-Joachim Vollmers. (4) Simulation of Tidal Energy and Regime of Navigable Channels by S. K. Bhattacharaya and K. K. Bandyopadhyay. (5) Untitled paper by A. de Visser and H. Speekenbrink. (6) The Use of the Hydraulic and Mathematical Models for the Testing of Dynamics of Estuaries, Utilized as Ports by Ewa Jasinska, Jerzy Piorewicz, Wojciech Robakiewicz, and Danuta Salska. (7) Untitled paper by Fernando M. Abecasis, Eurico C. Tome, Nelson A. Gomes, and others. (8) Special Features in the Design and Construction of the New Harbour for Bulk Cargoes at Richards Bay, Republic of South Africa, by N. P. Campbell and J. A. Zwamborn. (9) Estimation of Siltation in Dredged Channels in Open Situations by Brian Arthur O'Connor and George Henry Lean. (10) Untitled paper by Orville T. Magoon, Robert W. Whalin, and Milton Millard. (11) Improvement and Maintenance of Navigable Entrance Channels by V. G. Miroshnichenko and L. A. Logachev. References (158 items).

Pratte, B.D. Churchill River Salt Water Tidal Model. *(See complete entry in Section VI.)*

Proceedings of the Eighth Dredging Seminar, November 8, 1975. Texas A&M University, Center for Dredging Studies, CDS Report No. 195; Sea Grant Report TAMU-SG-77-102, December 1976.

Contents: Physical Factors Affecting Dredged Material Islands in a Shallow Water Environment, by James E. Stinson II, and Christopher C. Mathewson. A New Concept for Dredged Material Disposal, by Michael R. Palermo and Raymond L. Montgomery. Dredging Operations in the Galveston District, by Don S. McCoy. Dredge Material Containment in Nylon Bags in the Construction of Mini-Projects for Beach Stabilization, by Jerry L. Machemehl. Vessel Traffic System Houston-Galveston, by T. C. Volkle. The National Dredging Study, by W. R. Murden. An Investigation of the Environmental Impacts Associated with the Disposal of Dredged Material at the Offshore Disposal Site, Galveston, Texas, by David B. Mathis and Stephen P. Cobb. Use of Remote Sensing in Evaluating Turbidity Plumes, by Wesley P. James. Hydrologic and Sedimentologic Study of the Offshore Dredge Disposal Area, Savannah, Georgia, by George F. Oertel. References at end of some papers.

Purpura, J.A. Performance of a Jetty-Weir Inlet Improvement Plan. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 330-349.

Ponce de Leon Inlet is located in Volusia County on the east coast of Florida, about 65 miles south of St. Augustine Harbor and about 57 miles north of Canaveral Harbor. The inlet connects the Atlantic Ocean with the Halifax River and the Indian River North which are used extensively by commercial and recreational vessels. The mean tidal range is 4.1 ft in the ocean and 2.3 ft inside the inlet channel, with an estimated mean tidal prism of about 12,000 acre-feet. Past records (1,2) indicate an average annual recession of the mean low water line in the 2-mile reach immediately north of the inlet of about 7 ft per year. For the 4-mile reach immediately below the inlet, shoreline recession is accompanied by accretion of the offshore portion of the profile. The net average annual littoral transport rate in the vicinity of Ponce de Leon Inlet has been estimated to be in the neighborhood of 500,000 cu yd southerly and 100,000 cu yd northerly. Navigation through the original natural inlet had always been difficult and hazardous. A typical fan-shaped sandbar characterized the ocean entrance over which intense wave breaking took place. Inadequate depths across the bar and continuous shifting of the channel crossing that bar caused the principal difficulties and hazards to navigation. In July 1968, the Jacksonville District, US Army Corps of Engineers undertook the construction of an inlet stabilization system consisting of an entrance channel, a pair of jetties, and an impoundment basin south of the north jetty. The north jetty contained a submerged weir section to allow the southward moving sand to pass over it and deposit in the impoundment basin. This basin would then be dredged periodically with material being placed on the beach south of the inlet. This design was based on (a) the previously mentioned mean annual rate of southerly littoral drift, (b) an expected rapid accretion north of the north jetty, (c) negligible accretion immediately south of the south jetty, and (d) beach erosion farther south of the inlet. References (9 items).

Richardson, T.W. Systems for Bypassing Sand at Coastal Inlets. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 67-84.

Sand bypassing and related topics have been discussed in many publications over the years. Reference 1, for example, gives an excellent description of methods used and projects accomplished through 1972 in the United States, as well as a discussion of factors to be considered in designing for such methods. In 1972, however, a sand bypassing research program sponsored by the Office, Chief of

currents exceeded 2 knots, and in one instance, through a squall where wind speeds exceeded 50 knots and breaker heights were estimated at 8 ft. Principal advantages of the system are: its relatively low first cost; its tremendous flexibility in location of the jet pump intakes; its relative immunity to wave and current action; its simplicity of operation; and its noninterruption of navigation activities at a bypassing site. References (3 items).

Mehta, A.J., Wechmann, J., and Christensen, B.A. Sediment Management in Coastal Marinas: A Case Study. (See complete entry in Section II.)

Moor, R. Improvement Study for the Parachique Tidal Inlet. COASTAL ENGINEERING, 1(4):323-348, March 1978.

A fishing village became established at Parachique due to the nearness of good fishing areas and natural protection against wave action, offered by the tidal inlet. Not until after Peru's Ministry of Fisheries improved the infrastructures (quaywall, fish reception terminal, ice plants, cold stores, travel lift, etc.), were the problems often found at unstable tidal inlet's observed, i.e. location instability of the entrance and a shallow access channel. Under a Dutch Technical Cooperation program, the Engineering Services Office of the Ministry of Fisheries carried out an extensive field survey to determine the natural process of the tidal inlet and a study for possible improvements. The survey included detailed bathymetrics outside and inside the tidal inlet, float measurements, current measurements to calculate the flow rate, and simultaneous tide registration at several locations to enable reproduction of the tidal wave propagation in a mathematical model, in order to study the effect of several possible changes. This paper summarizes the most important aspects of the study, in which two alternative solutions emerged as technically feasible, both solutions involving jetties and a sand bypassing arrangement.

Muir Wood, A.M., and Fleming, C.A. Coastal Hydraulics, 2d ed. (See complete entry in Section I.)

Najarian, T.O., Thatcher, M.L., and Harleman, D.R.F. C & D Canal Effect on Salinity of Delaware Estuary. Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings, ASCE, 106(WW1):1-17, February 1980.

Analysis of the effect of C & D Canal on the salinity intrusion in the Delaware Estuary is described. Two separate mathematical models are used: MIT-Dynamic Network Model and MIT-Transient Salinity Intrusion Model. Emphasis is put on the investigation of simulated responses in the Delaware, rather than the Canal. The primary objective of the study is the investigation of salinity distribution in the Delaware under different forcing functions. MIT-DNM application reveals the behavior of a coupled Canal/Delaware system under natural boundary conditions specified at the Chesapeake Bay, Capes May and Henlopen, and at the head of tide at Trenton. MIT-TSIM application shows temporal and spatial salt distribution in the Delaware with salt and net flow condition specifications in the Canal. The results of these simulations indicate that salinity in the Delaware Estuary is appreciably affected by the dynamics of the Canal. However, the Canal has little discernible effect on the hydrodynamics of the Delaware. References (13 items).

Nasner, H. Transport Mechanism in Tidal Dunes. (See complete entry in Section II.)

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients. (See complete entry in Section IV.)

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. (See complete entry in Section I.)

North Sea Barrier Set to Launch. ENGINEERING NEWS-RECORD, 207(26):26-29. 24 December 1981.

This article discusses the construction of a storm barrier across the 9-km-wide Oosterschelde inlet south of Rotterdam. The barrier will extend 2.8 km across three channels formed by two work islands and a 36-m-high dike made of material dredged for the earlier project. The design calls for a working life of 200 years and an ability to withstand combined hydrostatic pressure and a quasi-static load on the floodgates equal to storm forces likely to occur once every 4,000 years. The structure will reduce tidal differences and lower current velocities in the inlet.

Nystrom, J.B., Hecker, G.E., and Moy, H.C. Heated Discharge in an Estuary: Case Study. (See complete entry in Section VI.)

O'Conner, B.A., and Thompson, G. A Mathematical Model of Chloride Levels in the Wear Estuary (UK). (See complete entry in Section VI.)

Olsen, E.J. A Study of the Effects of Inlet Stabilization at St. Marys Entrance, Florida. (See complete entry in Section II.)

Parker, G.C., Fang, C.S., and Kuo, A.Y. Thermal Discharges: Prototype vs. Hydraulic Model. (See complete entry in Section VI.)

Parthiot, F. Development of the River Seine Estuary: Case Study. (See complete entry in Section VI.)

Pequegnat, W.W., Fay, R.R., and Wastler, T.A. Combined Field-Laboratory Method for Chronic Impact Detection in Marine Organisms and Its Application to Dredged Material Disposal. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 631-648.

One of the difficult problems facing scientists who are concerned with the environmental effects of the disposal of dredged material and industrial wastes into the aquatic environment is determining whether or not given waste components elicit chronic deteriorative responses in important species of organisms (Pequegnat et al., 1978a). The full importance of such low-level, nonlethal effects is

Kluth, D.J., and Ackers, P. A Mathematical Model of the Closure Problem and Permanent Operation for Tidal Power Studies. (See complete entry in Section VI.)

Komar, P.D., and Terich, T.A. Changes Due to Jetties at Tillamook Bay, Oregon. (See complete entry in Section II.)

Krause, G. Grundlagen zur Trendermittlung des Salzgehalts in Tide-Aestuarien (Fundamentals of Trend Analysis of Salinity in a Tidal Estuary). (See complete entry in Section III.)

Krause, G. Physical Processes in Tidal Estuaries in Relation to the Monitoring of Water Quality. (See complete entry in Section III.)

Labens, J. Harbour Works for Ore-Carriers in the Republic of Guinea: Kamsar Harbour. In: Proceedings, Sixth International Harbour Congress, 12-18 May 1974, Antwerp, Belgium, 1974, 2.35/1-2.35/13.

The harbor is located in the estuary of Rio Nunez subjected to 5-m tides and 2-m/sec currents and intended to export 9,000,000 tons of bauxite per year. It is designed to accommodate ore carriers of up to 60,000-ton burden. The civil engineering works mainly comprise: (i) a wharf, 270 m long and equipped with a shiploader capable of pouring 4,250 tons/hr; (ii) a 1,536-m jetty, linking the wharf with the mainland and supporting a 1,600-mm belt conveyor; (iii) a waiting basin for ore carriers, with three boarding dolphins and two large mooring buoys. The wharf and jetty consist of a deck made of prefabricated concrete elements positioned with floating derricks. These elements rest on reinforced and prestressed concrete piles whose shafts were bored with the bentonite process. Their diameters vary from 80 cm to 2 m and their lengths from 25 to 42.50 m. In this paper the works achieved, the technical problems encountered, and the construction process used are described, especially the construction method of the prestresses bored piles ϕ 2 m, built in a 20-m-deep sea.

Langowski, R. A Strategy for Odra Estuary Ports. THE DOCK AND HARBOUR AUTHORITY, 62(735):273-275, February 1982.

This article describes a research program to develop the ports and transport routes in the Odra Estuary to their full commercial capacity. These investigations centered mainly on a research project entitled "Effective Utilization of Sea/River Qualities of the Odra Estuary for the Needs of the National Economy." The area under investigation consists of those regions neighboring on the river and the seawaters north of the bridges in Szczecin to the Polish frontier on the west and River Dziwna to the east.

Leatherman, S.P., ed. Barrier Islands: From the Gulf of St. Lawrence to the Gulf of Mexico. (See complete entry in Section I.)

Machemehl, J.L., Bird, N.E., and Chambers, A.N. Tidal Inlet Flow Dynamics and Sediment Movement. (See complete entry in Section II.)

Mason, C. Functional Design of Tidal Entrance Structures for Effective Navigation and Channel Stability. In: Proceedings, Seventeenth Congress of the International Association for Hydraulic Research, August 15-19, 1977, Baden-Baden, Federal Republic of Germany, 4(Subj.C): 173-180.

Effective design of tidal entrance structures requires an assessment of the hydraulic and sedimentary processes affecting the entrance as well as the navigational requirements of the design vessels. Results from the US Army Corps of Engineers' General Investigation of Tidal Inlets are presented which define the characteristics and impact of several of the processes. These results include field, laboratory, and numerical determinations of water level fluctuations and currents, historical analyses of the behavior of improved and unimproved entrances, and a geometric classification of natural tidal entrances. Procedures for establishing major design conditions (channel depth and width, protective structure length and spacing, and channel and structural alignment) are reviewed in light of these recent findings. References (16 items).

Mayor-Mora, R., Mortensen, P., and Fredsoe, J. Sedimentation Studies on the Niger River Delta. (See complete entry in Section II.)

McDowell, D.M. Training Works in Estuaries. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 22, 1973.

Four basic methods of training works in estuaries to accomplish four objectives are presented. Five general principles of hydrodynamic behavior in an estuary are discussed. Various types of watercourse training works such as revetments, training banks, and spurs or groins are given. Bed-load transport and suspended sediment control are also discussed. The lecture concludes with a discussion of methods of control of tidal propagation. References (5 items).

McNair, E.C., Jr. A Sand Bypassing System Using a Jet Pump. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1342-1360.

All harbors and tidal inlets that are located in coastal areas have one characteristic in common--the need to bypass littoral materials that collect nearby. If natural harbors and tidal inlets are left unattended, bypassing will often occur naturally, but in the process, the harbor or inlet is usually rendered unfit for commercial or navigation purposes. Quite often, the inattention results in the total closure of the inlet. Therefore, at almost all harbor entrances and controlled tidal inlets, the natural bypassing must be augmented by secondary, usually mechanical, means. The jet pump sand bypassing system is simple in design and application and offers the coastal engineer an additional option in his search for solutions to coastal problems. The system has been demonstrated to be rugged, reliable, and effective. During the field tests on the Gulf of Mexico and at Rudee Inlet, Virginia, the system operated successfully in the surf zone, in areas where the

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. (See complete entry in Section I.)

Haller, D.L. Demonstration of Advanced Dredging Technology Dredging Contaminated Material (Kepone) James River, Virginia. In: Proceedings of the 6th US/Japan Meeting on Management of Bottom Sediments Containing Toxic Substances, Tokyo, Japan, 16-18 February 1981, 39-49.

A demonstration project to be conducted on the James River, Virginia, will compare the efficiency, plant output, and environmental advantage of dredging contaminated material with a typical hydraulic dredge equipped with a cutterhead and a dustpan head. The comparison of the two excavating methods (heads) will be conducted under controlled conditions in the maximum turbidity zone of the river, where channel sediments are laced with the insecticide KEPONE. The project will entail the conversion of a typical cutterhead dredge to a dustpan dredge. The dustpan dredge will be equipped with necessary control cables for maneuverability in a tidal estuary and the head will be appropriately modified to effectually skim dredge the 18- to 24-in. layer of polluted sediment. Dredging will be conducted in selective areas, continually monitored with both on-board and off-dredge instrumentation, and the dredge and head accurately positioned at all times. Environmental monitoring will be conducted around the dredge and at the discharge. Following the excavation by dustpan, the dredge will be reconverted to the cutterhead mode and the test dredging conducted in comparable areas under identical conditions. The purpose of the project is to demonstrate that equipment, readily available in the United States, can efficiently excavate toxic "hot spots" from the nation's channels and harbors; that total containment of the pollutant is possible; that secondary turbidity release can be minimized; that the material can be removed at in situ density; that containment problems at the disposal site can be significantly reduced; and that the cleanup effort can be accomplished at a reasonable cost. It is further believed that the demonstration project will yield applied technology that will benefit the dredging industry and environment.

Hamaguchi, S. Pollution Studies at Tsu-Matsuzaka Harbor and Removal of Sediment at Estuaries near It. In: Proceedings of the 6th US/Japan Meeting on Management of Bottom Sediments Containing Toxic Substances, Tokyo, Japan, 16-18 February 1981, 266-286.

With the economic progress of our country, the water pollution in Mie Prefecture, especially along the shore of Ise Bay, has worsened year by year. Since the districts near Tsu and Matsuzaka are most densely polluted and most active in industries among Mie Prefecture, the water pollution is an important environmental problem. To meet this problem, the prefectural government recently performed pollution studies near the harbor and established a cleanup plan. The paper deals with the results of the pollution studies and reports how sediment removal was carried out as scheduled for the first year of the total plan, and how the dredged material was managed.

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. (See complete entry in Section I.)

Holloway, P.E. Longitudinal Mixing in the Upper Reaches of the Bay of Fundy. (See complete entry in Section III.)

Hubbard, D.K. Changes in Inlet Offset Due to Stabilization. (See complete entry in Section II.)

Hudson, R.Y., et al. Coastal Hydraulic Models. (See complete entry in Section VI.)

Jones, C.P., and Mehta, A.J. A Comparative Review of Sand Transfer Systems at Florida's Tidal Entrances. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 48-66.

Sand transfer systems are oftentimes necessary components in an inlet improvement system for two reasons. First, the ability of a tidal inlet to naturally flush material from its channels may not be adequate to meet navigation requirements. Second, the improvement of a tidal inlet may interfere with the inlet's ability to naturally bypass materials from one side to the other; hence, shoreline erosion is frequently intensified in the vicinity of the inlet. In this study six types of sand transfer systems, which have been and are currently employed at Florida's tidal entrances, are reviewed and compared. Emphasis has been placed on the engineering and the economic efficiencies, and on the hydraulic and the sedimentary characteristics relating to entrance stability and natural bypassing tendencies. The performance of the various sand transfer systems is discussed in light of these data. Finally, the economics of the systems are compared on the basis of the average annual cost per cubic yards of sand transferred. References (6 items).

Jones, C.P., and Mehta, A.J. Inlet Sand Bypassing Systems in Florida. SHORE AND BEACH, 48(1):25-34), January 1981.

The stabilization of a tidal inlet can interfere with the natural bypassing of sedimentary material at the inlet and result in increased shoaling of the navigation channel as well as accelerated erosion of beaches adjacent to the inlet. Several sand bypassing systems have been utilized for the purpose of alleviating these problems, although they have met with varied degrees of success. Some of the problems bypassing methods employed at tidal inlets in Florida are described, emphasizing their history, economics, and effectiveness. The State's role in sand bypassing has been summarized. References (18 items).

Kadib, A.A. Sedimentation Problems at Offshore Dredged Channels. (See complete entry in Section II.)

Kendrick, M.P., and Derbyshire, B.V. Factors Influencing Estuary Sediment Distribution. (See complete entry in Section II.)

Edge, B.L., O'Brien, J.F., and McCoy, J.E. Methodology for Siting Power Plants on Industrialized Estuaries. (See complete entry in Section IV.)

Engineering Problems in Estuaries. HYDRO DELFT, (54):8-9, July 1979.

In recent decades knowledge on the morphology and hydraulics of rivers and estuaries has improved considerably as a result both of experience and much fundamental research. This has given the engineers a tool to find proper solutions for today's problems, provided sufficient field data are available. In general, these problems have increased as a consequence of the enlarged scales involved in almost every engineering project. Due to the greatly expanded scales of the projects, the interference of a project with the processes and environment in an estuary or river has increased, making the study on a project more complex than in the past. The complexity of some problems in an estuary can be elucidated by a very common problem: the improvement of an existing seaport. An important aspect of solving the engineering problems in estuaries is the obtaining of sufficient field data for the boundary conditions.

Falconer, R.A. Application of Numerical and Physical Models in Harbour Design. (See complete entry in Section VI.)

Fischer, H.B., ed. Transport Models for Inland and Coastal Waters. (See complete entry in Section VI.)

Floyd, C.D., and Druery, B.M. Results of River Mouth Training on the Clarence Bar, New South Wales, Australia. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1738-1755.

A case study is given of river training works at the mouth of the Clarence River. The study spans a period of 90 years. Extensive hydrographic data from the later part of this period is presented and examined in detail. Prior to 1903 internal training walls had been constructed to stabilize the internal channel and stabilize the bar location at the mouth of the Clarence River. In 1956 construction started on entrance jetties with the aim of deepening the bar. The slow rate of construction has allowed changes in bar depths to be compared with depths estimated by an empirical formula which relates bar depth to tidal flow and channel width. Results have shown that the empirical formula gives a reasonable estimate of bar depths and that bar depth is independent of jetty length but that bar behavior is strongly affected by floods. Reference (1 item).

Giese, E. Investigation of Training Structures in a Tidal Model with Movable Bed. (See complete entry in Section VI.)

Göhren, H. Port of Hamburg Flood Control. THE DOCK AND HARBOUR AUTHORITY, 61(717):112-114, August 1980.

The Port of Hamburg is an open tidal port situated approximately 100 km upstream from the mouth of the Elbe, Germany's largest tidal river. Throughout its long history, the port and city of Hamburg have always been threatened by floods whenever heavy gales from the northwest swept across the German Bight, whipping up huge waves and thereby swelling the tidal flow in the Elbe. Plagued by flooding from the tidal river Elbe, the Port of Hamburg has introduced measures aimed at providing an effective early warning system along with localized flood protection devices. This article describes these measures and the backup services which allow their effective implementation.

Great Britain, Hydraulics Research Station. Gambia Barrage Study; Effect of the Barrage on the Tidal Regime Downstream. Report No. EX-795, December 1977.

A mathematical model was used to simulate tidal propagation in the estuary of the River Gambia. The proven model was then used to predict the effect of a proposed barrage at Yelitenda, about 134 km from the mouth, on the tidal regime in the truncated estuary. The method of species analysis was used to quantify the changes to the tidal regime. The main conclusion of the study was that the construction of a barrage near Yelitenda would cause a minimum amplification of the local tide compared with any other location in the estuary. References (7 items).

Great Britain, Hydraulics Research Station, Wallingford. Thames Estuary Flood Prevention Investigation; The Effect of a Half Tide Barrier at Either Woolwich or Blackwall on Siltation in the Estuary. Mathematical Silt Model Studies. Report No. EX 479, January 1970. 2 Volumes.

A tidal barrier has been proposed for the Thames Estuary to protect Central London from flooding by North Sea storm surges. A mathematical model has been developed to assist in predicting the overall effects of such a barrier on siltation in the estuary. The model simulates the movement of water and silt in an idealized version of sixty miles of the estuary. The model showed that a half tide barrier at either Woolwich or Blackwell, closing at midebb and opening at midflood tide, greatly reduced the suspended concentrations in the estuary, and tended to move the region where the silt accumulates, known as the Mud Reaches, seawards. References (12 items).

Gregory, P. The Dying Estuary. SOIL AND WATER, 17(2):18-19, April 1981.

This article discusses the problems associated with the Maketu Estuary since the diversion in 1956 of the Kaituna River at Te Tume to flow through "The Cut," at the farthest end of the bar from Maketu township. It appears that the 1956 diversion and the 1974 blocking of a causeway, which until then had allowed river water to continue flowing through the estuary, are the direct causes of the present problems. With the mouth of Maketu Estuary slowly closing up due to the buildup of sand, navigation has been restricted. A study revealed the following two options: (1) to construct and maintain a stable outlet from the estuary to the sea; or (2) to abandon the sea outlet, allow natural deterioration to continue, and provide for discharge of drainage of the estuary catchment into the Kaituna River.

Falconer, R.A. Application of Numerical and Physical Models in Harbour Design. THE DOCK AND HARBOUR AUTHORITY, 63(737):34-37, April 1982.

Research being pursued at Birmingham University has led to the development of a numerical model that can readily be used to predict the tide induced velocity fields and concentration distributions in harbors and estuaries, particularly where a narrow entrance exists. This numerical model, in conjunction with a similar laboratory model study, has been used to compare the flushing efficiency and mixing characteristics of a number of different rectangular harbors, each having the same planform area and entrance width but with varying length to breadth ratios. Results of both the numerical and laboratory model studies show that a square harbor has the maximum flushing efficiency and mixing characteristics and is therefore the ideal shaped rectangular harbor to design from the water quality standpoint. Also, use of impermeable barriers has often been proposed in an attempt to improve the flushing efficiency of a harbor known generally to have poor water quality characteristics. However, research shows that this remedial approach should always be treated cautiously since results indicate that barriers can be more detrimental rather than beneficial to the net water quality characteristics. References (6 items).

Falconer, R.A. Numerical Modeling of Tidal Circulation in Harbors. Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings, ASCE, 106(WW1):31-48, February 1980.

In this study a numerical model has been developed that can be used to predict the two-dimensional tide-induced velocity fields in harbors and estuaries. The model is particularly suited to basins having a narrow entrance where, on the incoming tide, the divergence of the velocity field associated with the jet inlet gives rise to the generation of vorticity. The time-dependent nonlinear equations of motion are formulated to include the effects of bottom roughness, wind action, the Earth's rotation, and a simplified version of the turbulent transfer of momentum. These equations are expressed in an alternating-direction implicit finite difference form and are solved by Gaussian elimination. The numerical model has been checked by making comparisons between the computed velocity fields and experimentally measured velocities and path lines for two hydraulic model studies involving various rectangular harbors and a circular reservoir. References (15 items).

Farmer, R.C., and Waldrop, W.R. A Model for Sediment Transport and Delta Formation. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 102-115.

A mathematical procedure was developed for predicting the transportation and deposition of suspended material in streams. This procedure was used to mathematically model the formation of a delta so that the effects of river and tidal flow on the deposition of sediment and on bed migration could be predicted. The objective of the study was to develop a tool, in the form of a computer program, which described the important features known to control the movement of suspended material and hence the formation of deltas. References (13 items).

Fischer, G. Results of a 36-Hour Storm Surge Prediction of the North Sea for 3 January 1976 on the Basis of Numerical Models. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 32(3):89-99, 1979.

To explore the feasibility of forecasting North Sea storm surges by integrating numerically a combined atmospheric-oceanographic physical model, the severe storm and the resulting water levels occurring on 3 January 1976 were simulated as a first step in this direction. For this purpose, the atmospheric model was run with a resolution of 8 levels in the vertical and a horizontal grid spacing of 1.4° in latitude and 2.8° in longitude on the hemisphere. The initial conditions are based upon observations of 2 January 1976, 12 GMT, i.e. about 24 hours before the storm reached its greatest intensity in the southern parts of the North Sea. The surface wind predicted by the atmospheric model was converted into stress values through a bulk formula which then entered the vertically integrated North Sea model to yield the desired water elevations in a 22-km grid. Also, the observed wind, stemming from a careful reanalysis of the storm situation, was handled in the same way. The numerically obtained results were compared with gauge measurements at a number of coastal stations. References (11 items).

Fischer, H.B., ed. Transport Models for Inland and Coastal Waters; Proceedings of a Symposium on Predictive Ability of Surface Water Flow and Transport Models, held in Berkeley, California, August 18-20, 1980. New York, Academic Press, 1981. 542p.

Contents: I. Mathematical Modeling of Flows and Transport of Conservative Substances: Requirements of Predictive Ability by Gerrit Abraham, Adriaan G. van Os, and Gerrit K. Verboom. II. The Predictive Ability of One-Dimensional Estuary Models by Nicholas V. M. Odd. III. Prediction of Flow and Pollutant Spreading in Rivers by W. Rodi, R. N. Pavlovic, and S. K. Srivatsa. IV. Modeling of Lagoons: The Experience of Venice by G. Di Silvio and G. Fiorillo. V. Techniques for Field Verification of Models by Donald W. Pritchard. VI. Spectra Preservation Capabilities of Great Lakes Transport Models by Keith W. Bedford. VII. Numerical Modeling of Free-Surface Flows that are Two-Dimensional in Plan by M. B. Abbott, A. McCowan, and I. R. Warren. VIII. A Three-Dimensional Model for Tidal and Residual Currents in Bays by Kim-Tai Tee. IX. A Dynamic Reservoir Simulation Model--DYRESM: 5 by Jorg Imberger and John C. Patterson. X. Modeling of Heated Water Discharges on the French Coast of the English Channel by Francois Boulot. XI. Two-Dimensional Tidal Models for the Delta Works by J. J. Leendertse, A. Langerak, and M. A. M. de Ras. XII. Predictive Salinity (Modeling of the Oosterschelde with Hydraulic and

Mathematical Models by J. Dronkers, A. G. van Os, and J. J. Leendertse. XIII. A Two-Dimensional, Laterally Averaged Model for Salt Intrusion in Estuaries by P. A. J. Perrels and M. Karelse. References are given at the end of each chapter.

Fischer, K. Numerical Model for Density Currents in Estuaries. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976. Honolulu, Hawaii, IV:3295-3311.

A numerical model for density currents in estuaries was presented, combining a classical solution scheme for the dynamical equations with a new solution scheme for the transport equation. The effects of baroclinic forces caused by density differences were studied in a two-dimensional x-z-model, and the results for a stationary salt wedge were shown to be in good agreement with a semianalytic solution and experimental data. The uniqueness of the numerical solution was checked by varying the initial and boundary conditions. The influence of bottom friction, a bottom barrier, and tidal motions were studied; and the stationary solution for a well-mixed estuary was obtained. References (14 items).

Flugge, G. Horizontal Diffusion in Tidal Models and Scaling Criteria for Thermal Hydraulic Model Tests. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3097-3107.

Near Brokdorf at the lower Elbe river (West Germany) a nuclear power plant is projected. The electric energy output shall be 1300 MWe. For the purpose of the mixing and spreading of the discharged cooling water by mean tidal conditions and storm-tide conditions model tests have been carried out at the Franzius-Institut of the Technical University of Hanover. References (3 items).

Gardner, G.B., Nowell, A.R.M., and Smith, J.D. Turbulent Processes in Estuaries. (See complete entry in Section I.)

Gardner, L.R. Geomorphic and Hydraulic Evolution of Tidal Creeks on a Subsiding Beach Ridge Plain, North Inlet, S.C. (See complete entry in Section II.)

Garrett, C., and Toulany, B. A Variable-Depth Green's Function for Shelf Edge Tides. JOURNAL OF PHYSICAL OCEANOGRAPHY. 9(6):1258-1272, November 1979.

The Green's function for a semi-infinite ocean with depth a function of distance from the boundary is developed numerically for the M_2 frequency and with Coriolis frequency and depth profile appropriate to the continental slope off the Gulf of Maine. This involves numerical integration of the linearized shallow water equations for all longshore wave numbers, followed by numerical Fourier transformation. This variable-depth Green's function is approximately equal to Buchwald's (1971) constant-depth Green's function for distances along the boundary greater than the width of the slope, and at very short range tends to limiting values which can be approximated analytically. The Green's function, when combined with currents from Greenberg's (1979) numerical model of the Bay of Fundy and Gulf of Maine, is used to explain substantial observed variations in M_2 amplitude and phase along the edge of the shelf off the Gulf of Maine; the variable-depth Green's function produces significantly better results than the constant-depth Green's function. The results support the basic premise that the M_2 elevation at the shelf edge in the absence of the Gulf of Maine would be fairly constant, and suggest ways of deriving open boundary input for tidal models of coastal seas with a minimum of offshore gaging. References (10 items).

George, K.J. and Bates, D.J. The 60 Year Sea Level at Barnstaple as Estimated Using the Convolution Method. THE INSTITUTION OF CIVIL ENGINEERS, PROCEEDINGS, 69(Pt.2):827-834, September 1980.

A design level was required for proposed civil engineering works in the Taw and Torridge estuaries in north Devon. This was to be associated with a return period of 60 years, and to take account of tides and their perturbations by weather. The duration of available observed high water levels was too short to apply conventional frequency analysis, and so a convolution technique was used. References (6 items).

Giese, E. Investigation of Training Structures in a Tidal Model with Movable Bed. In: Proceedings of Seventh Congress of the International Association for Hydraulic Research, August 15-19, 1977, Baden-Baden, Federal Republic of Germany, 4(Subj.C):9-16.

This paper deals with recently performed model investigations for the Elbe Estuary with regard to the extension of a training wall in the sea area and schemes for a new one in the upstream river section. The Elbe tidal river is an example of a navigation channel recently deepened to overcome the difficulties of maritime traffic and the mentioned artificial structures shall serve to stabilize effectively the channel course, simultaneously minimizing future general dredging activities. The influence of training structures apparently depends on their position in the estuary, and their molding and crest height. To determine the most advantageous and simultaneously economic configurations, it is now a conventional procedure to investigate these structures in the mobile bed model of the Elbe River comparing the different results of the morphological development. References (4 items).

Gill, S.K. and Porter, D.L. Theoretical Offshore Tide Range Derived from a Simple Defant Tidal Model Compared With Observed Offshore Tides. INTERNATIONAL HYDROGRAPHIC REVIEW, MONACO, 57(1):155-167, January 1980.

A simple Defant model, based on the M_2 constituent, is presently used by the National Ocean Survey to estimate the offshore range of the tide, with observations at coastal tide stations of the actual tide supplying the necessary boundary condition for the model. The calculated values provide preliminary tide

correctors for soundings obtained in offshore hydrographic surveys. Using offshore tide data from Deep Sea Tide Gage (DSTG) deployments and Offshore Telemetering Tide System (OTTS) buoys, the quantitative effects of the continental slope and shelf on the incoming semi-diurnal tide are discussed, and anomalies in the predicted tide curve due to Hurricane Belle are shown. Comparison of the observed tide range with the theoretical tide range reveals the need to modify the initial Defant model, which is accomplished by decomposing the range into its major harmonic constituents, resulting in an improved calculated offshore range. References (7 items).

Godfrey, J.S. A Numerical Model of the James River Estuary, Virginia, U.S.A. ESTUARINE AND COASTAL MARINE SCIENCE, 11(3):295-310, September 1980.

A numerical model of a partially mixed estuary is postulated, in which temporal changes in density current and vertical salinity stratification at a given point depend only on the longstream gradient of cross-sectional average salinity, $\bar{S}$, and the tidal speed, $|U|$, averaged over a tidal period. The salt conservation requirement leads to a partial differential equation on $\bar{S}$: under steady state conditions this becomes an ordinary differential equation that can easily be solved analytically for an estuary bed of any shape. The qualitative features of the solution are similar to those of real and laboratory model partially mixed estuaries. The time-dependent equation on $\bar{S}$ is solved numerically, for the James River, U.S.A., in the 2-month period following Hurricane Agnes (June 1972). Agreement with observation is good, considering the extreme simplicity of the model. In particular, it is found in both observation and model, (i) that salt penetration up the James River appears to respond strongly and rapidly to changes in salinity at the mouth, overshadowing the responses to changing riverflow and the spring neap cycle; (ii) that stratification depends primarily on the spring-neap tidal cycle, and very little on riverflow. References (11 items).

Göhren, H. Currents in Tidal Flats During Storm Surges. (See complete entry in Section I.)

Gopalakrishnan, T.C. and Machemehl, J.L. Numerical Flow Model for an Atlantic Coast Barrier Island Tidal Inlet. UNC Sea Grant Publication UNC-SG-78-02, Raleigh, North Carolina State University, April 1978.

A numerical model for computation flow in inlets with junction is developed. The Galerkin technique is coupled with a finite element analysis in the flow model. The vertically integrated equations of momentum and mass conservation are used with appropriate boundary and initial conditions. The junction conditions are introduced by the time rates of change of energy and mass flux at the junction. A 'double sweep' approach is used in solving for the dynamics of flow. A parabolic shape function is adopted in the model to satisfy the requirement of linear independence. The numerical flow model is verified with field data for Carolina Beach Inlet, North Carolina. The tidal fluctuations in the inlet gorge and tidal velocities in the Atlantic Intercoastal Waterway were used as initial and boundary conditions, respectively. The tidal velocities in the inlet gorge and tidal fluctuations in the Atlantic Intercoastal Waterway were computed with the numerical simulation flow model and compared with field data. The Galerkin finite element flow model performed well considering the complex nature of flow in a tidal inlet. References (8 items).

Gordon, R.B., and Spaulding, M.L. A Nested Numerical Tidal Model of the Southern New England Bight. Rhode Island University, Department of Ocean Engineering, National Aeronautics and Space Administration, CR-158020, January 1979.

Efforts were focused on the development and application of a three-dimensional numerical model for predicting pollutant and sediment transport in estuarine and coastal environments. To successfully apply the pollutant and sediment transport model to Rhode Island coastal waters, it was determined that the flow field in this region had to be better described through the use of existing numerical circulation models. A nested, barotropic numerical tidal model was applied to the southern New England Bight (Long Island, Block Island, Rhode Island Sounds, Buzzards Bay, and the shelf south of Block Island). Forward time and centered spatial differences were employed with the bottom friction term evaluated at both time levels. Using existing tide records on the New England shelf, adequate information was available to specify the tide height boundary condition further out on the shelf. Preliminary results are within the accuracy of the National Ocean Survey tide table data. References (29 items).

Gordon, R.B., and Spaulding, M.L. A Three Dimensional Numerical Model of Estuarine Circulation. In: Proceedings, 25th Annual Hydraulics Division Speciality Conference on Hydraulics in the Coastal Zone, New York, ASCE, 1977, 19-27.

This paper describes the development of a three-dimensional numerical model of circulation and salt distribution for estuarine and coastal application. A vertical coordinate transformation is described. This coordinate transformation has the advantage of mapping the free surface and bottom boundaries onto coordinate surfaces and allows for a uniform vertical grid resolution throughout the modeled region. It also results in some distinct advantages over previous, arbitrarily layered approaches. Explicit finite differences are used to approximate the system of coupled, nonlinear partial differential equations. References (7 items).

Gotlib, V.Y., and Kagan, B.A. Parameterizing Shelf Effects in Modeling the Ocean Tides (in English). ATMOSPHERIC AND OCEANIC PHYSICS, 15(4):292-297, 1979.

Two methods of parameterizing the shelf effects are proposed: one of the local and the other of the integral type. They are used for modeling the tides in the deepwater part of

the model ocean simulating the South Atlantic in the region of the Patagonian shelf. A comparison of the obtained data with the results of the solution to the general problem for an ocean-shelf system shows that in typical conditions both methods give a sufficiently high accuracy in determining the characteristics of the semidiurnal tide.

Graf, W.H. Hydraulics of Sediment Transport. (See complete entry in Section II.)

Great Britain, Hydraulics Research Station. Gambia Barrage Study; Effect of the Barrage on the Tidal Regime Downstream. (See complete entry in Section V.)

Great Britain, Hydraulics Research Station, Wallingford. Thames Estuary Flood Prevention Investigation; The Effect of a Half Tide Barrier at Either Woolwich or Blackwall on Siltation in the Estuary. (See complete entry in Section V.)

Grubert, J.P. Estuarine Front Formation and Propagation. (See complete entry in Section III.)

Grubert, J.P. Experiments on Arrested Saline Wedge. (See complete entry in Section III.)

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. (See complete entry in Section I.)

Hamilton, G.D., Soileau, C.W., and Stroud, A.D. Numerical Modeling Study of Lake Pontchartrain. Journal of the Waterway, Port, Coastal, and Ocean Division, Proceedings, ASCE, 108(WW1):49-64.

A Hansen-type hydrodynamical-numerical model is shown to adequately simulate actual wind circulation, water levels, and particulate matter dispersion in Lake Pontchartrain. The model is an explicit numerical difference scheme based on leapfrog integration through time of the two-dimensional Eulerian form of the hydrodynamical equations to obtain a dynamical boundary-value solution of tidal order. The differential equations are derived by integration of both x and y velocity components through a layer of assumed uniform density to achieve vertically averaged mean components. Terms to account for rotation of the earth, wind and tidal forcing, and dissipative frictional effects are included. The diffusion and advection method used is a Monte Carlo stochastic process in which the model provides the advectional flow. Two simple applications demonstrate the ability of this model to accurately represent the movement of a lake surface under the influence of tides and wind. A third application demonstrates the ability to model the injection and plume dispersion of particulate matter in lakes. References (17 items).

Hamilton, J. Finite Difference Storm Surge Prediction. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 32(6):267-278, November 1979.

A high-quality finite difference model for modeling storm surges or tides in conformal coordinates is described. The model is used to discuss the propagation of a surge through a narrow strait and is indicated as a basis for a hybrid empirical-finite difference prediction scheme for storm surges. References (9 items).

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. (See complete entry in Section I.)

Harleman, D.R.F. Hydrodynamics of Tidal Motion. (See complete entry in Section I.)

Harten, H., and Ramming, H.G. Reproduction of Dynamical Processes in the Jade-Weser Estuary. In: Proceedings, Seventeenth Congress of the International; Association for Hydraulic Research, Hydraulic Engineering for Improved Water Management, August 15-19, 1977, Baden-Baden Federal Republic of Germany, 2(Subj.A):163-270.

In the construction phase of large area physical tidal models often it is difficult to determine the model borders in the sea region because sufficient natural values are lacking. Therefore, recently it is practical to use mathematical models for getting current fields in the sea border part. An example shall be the Jade-Weser estuary. In the main merchant shipping routes Jade and Weser improvements will have to be done. To get a forecast regarding the hydraulic and morphological effect, a big hydraulic tide model was built. The border and control conditions in the sea part became reconsidered by a mathematical model. The mathematical method is based on the hydrodynamic equations. Starting basis is the so-called North Sea model. References (5 items).

Hauck, L.M. and Ward, G.H. Hydrodynamic-Mass Transfer Model of Deltaic Systems. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 247-268.

A branching section-mean model has been developed for the simulation of the hydrodynamics and nutrient transport in estuarine deltaic systems, in which the momentum conservation, continuity, and mass transfer equations are solved by the method of finite differences. Example executions of the hydrodynamic portion of the model are presented for the Lavaca, Guadalupe, and Trinity deltaic systems. Computed water elevations and flows are compared to observations to evaluate model performance for a variety of conditions. The model is shown to obtain satisfactory results for conditions of variable freshwater inflow, such as associated with small-to-moderate floods, and meteorologically influenced tides, e.g., wind-induced setup or setdown, as well as low-flow, astronomical-tide regimes. References (7 items).

Hayter, E.J. Verification of the Hydrodynamic Regime of a Tidal Waterway Network. University of Florida, Coastal and Oceanographic Engineering Laboratory, UFL/COEL-79-001, March 1979.

Two numerical models are developed for the purpose of the prediction of tidal motions in

a waterway network. In addition, these models may be used for the verification of changes in the hydrodynamic regime resulting from modifications made to a network system. Typical modifications may be either natural or man-made in origin and include such changes as dredging, structural construction, and the opening (or closure) of waterways within the system. The first model developed is a method for discharge computation in unsteady open channel flow. The discharge is calculated from a velocity measurement at any location in the flow cross section and a knowledge of the water surface elevation, geometry, and bed roughness of the section. The second model is a finite difference hydrodynamic model which computes the water levels and discharges in a tidal waterway network. The network may consist of any geometrical configuration of branching waterways and storage areas. The models are applied to the waterway network in the vicinity of Matanzas Inlet on the east coast of Florida to verify changes in the hydrodynamic regime resulting from the closure of a dike breakthrough. Comparisons of the results with field measurements indicate good agreement. References (17 items).

Herrling, B. Finite Element Model for Estuaries with Inter Tidal Flats. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3396-3415.

The paper deals with finite-element formulations for the numerical computation of two-dimensional incompressible long-period shallow-water waves. The described mathematical model is used to reproduce the dynamic situation occurring at the tidal propagation in estuaries. Areas which fall dry and wet again within a tidal cycle (so-called inter-tidal flats) are taken into account. References (11 items).

Higgs, K., et al. Tidal Hydraulics of Botany Bay (Volumes 1 and 2). (See complete entry in Section VIII.)

Hodgins, D.O. A Time Dependent Two-Layer Model of Fjord Circulation and Its Application to Alberni Inlet, British Columbia. ESTUARINE AND COASTAL MARINE SCIENCE, 8(4):361-378, April 1979.

A mathematical mode for unsteady fjord circulation is presented in a form suitable for numerical solution, together with the corresponding finite difference scheme for subcritical flows. The method allows integration of the equations of motion with a time step independent of the spatial grid thus achieving a sufficient degree of economy for deepwater simulations. Applications are made to Alberni Inlet for various boundary conditions and the model response is discussed in terms of observations from the fjord. A coefficient for interfacial friction, based on a linear velocity shear law, is calculated using observations from the inlet and found to be approximately 0.0025 m^2s^{-1} . The effects of lateral friction are also included with a quadratic velocity shear relation. The bulk friction coefficient in this term is determined by calibration to be approximately 0.075 for an average inlet width of 1200 m. References 19 items).

Holloway, P.E. Longitudinal Mixing in the Upper Reaches of the Bay of Fundy. (See complete entry in Section III.)

Holz, K.-P. Analysis of Time Conditions for Hybrid Tidal Models. In: Proceedings of the Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3460-3470.

Hybrid models for the investigation of tidal waves in rivers and estuaries are a combination of mathematical and hydraulic models, which are coupled under real-time conditions. The coupling procedure cannot be performed without some time delay which mainly depends on the time needed for the computation of the mathematical model and for the control operations on the instrumentation. An analysis of their influence on the accuracy of a hybrid model is given and experimental results from a feasibility study are presented. References (5 items).

Hudson, R.Y., et al. Coastal Hydraulic Models. US Army Coastal Engineering Research Center, Special Report No. 5, May 1979.

This report describes the use of hydraulic models to assist in the solution of complex coastal engineering problems. This report provides information for use by both the laboratory research engineer and the field design engineer on the capabilities and limitations of coastal hydraulic modeling procedures. The report is intended to provide sufficient information to document the state-of-the-art of scale modeling practiced by the US Army Engineer Waterways Experiment Station (WES); and for field design engineers and other laboratory research engineers to better understand the principals of scale models and the application of these principles in the design, construction, and operation of scale hydraulic models in the solution of problems involving the interaction of waves, tides, currents, and related sediment movements in estuaries, coastal harbors, coastal erosion, and stability of coastal structures and inlets. Literature Cited (295 items).

Ianniello, J.P. Tidally-Induced Residual Currents in Long Island and Block Island Sounds. (See complete entry in Section I.)

Illanovicq, R.E. Modeling the Chesapeake Bay and Tributaries: A Synopsis. CHESAPEAKE SCIENCE, 17(2):114-122, June 1976.

The last decade has seen the development and application of a spectrum of physical and numerical hydrographic models of the Chesapeake Bay and its tributaries. The success of the James River Hydraulic Model has initiated the construction of an estuarine hydraulic model of the entire Chesapeake System. Numerical analogs for hydrographic behavior and contaminant dispersion in one-, two-, and three-dimensional model estuaries exist for various regions of the Bay. From an engineering viewpoint, one-dimensional models are sufficiently advanced to be routinely employed in aiding management decisions. Bay investigators are

playing leading roles in the development of two- and three-dimensional models of estuarine flows. References (49 items).

Isozaki, I., and Kitahara, E. Tides in the Bays of Ariake and Yatsushiro. (See complete entry in Section I.)

Jain, S.C., and Kennedy, J.F. An Evaluation of Movable-Bed Tidal Inlet Models. US Army Corps of Engineers, General Investigation of Tidal Inlets, GITI Report 17, February 1979.

The objective of this study was to evaluate the effectiveness of movable-bed tidal inlet hydraulic models in predicting prototype behavior, by comparing model predictions with the observations made in the prototype, and to examine the scaling requirements for such models. Model studies of this type have been conducted in the United States and Canada only by the US Army Engineer Waterways Experiment Station (WES). Seven model studies were conducted by WES during the period 1939 to 1969. The calibrations of five of these models, as measured by bed topography changes, are evaluated by means of quantitative indicators, including correlation coefficients, and root-mean-square (rms) error. The values of correlation coefficients, disregarding measurement errors and prototype soundings, were generally low and those of rms error high. If combined model and prototype sounding errors of 2 to 3 ft (0.61 to 0.91 m) were allowed, the correlation coefficients were somewhat higher and the rms errors lower. *Evaluation of data from* the Galveston Harbor entrance model revealed that the shoaling rates and distribution along the navigation channel predicted by the model are not in good agreement with the prototype data. It was concluded that the model reproduction of details of bed topography was less accurate than that which might have been obtained had the similitude criteria proposed here been used, and had more complete prototype data been available for calibration. Disagreement between model and prototype is believed to have been due to: (a) scale effects introduced by nonsimilarity of the physical processes; (b) insufficient prototype data for calibration and verification; (c) oversimplification of the available prototype data for use in the model study; and (d) experimental errors. In all cases, the prototype data utilized for model calibration were decidedly inadequate, and the similitude requirements followed, especially those related to the sediment, were deficient in light of recent advances in understanding of coastal sediment transport. A literature review was conducted to determine the present understanding of the practice concerning similitude requirements for movable-bed coastal inlet models. Similitude conditions for models of this type are recommended. Literature Cited (31 items).

Jain, S.C., and Kennedy, J.F. Movable Bed Tidal Inlet Models. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3435-3444.

Stabilization of tidal inlets is a major engineering problem that is frequently encountered in the development of harbors. Prediction of the sedimentary response of an existing inlet to artificial improvements and to changing environmental conditions, or of a new inlet to the expected ambient conditions, and the optimization of the layout in order to minimize undesirable accretion or erosion are major elements in the design of tidal inlets. Because of the complexity of the problem, movable bed hydraulic models often are employed, despite the questions that surround their validity, to investigate these responses and to guide designs. The success of a movable bed hydraulic model depends upon the proper choice of similitude conditions and modeling criteria. The main emphasis of this study is on comparison of model predictions with observations made in the prototypes, and evaluation of model performance in the light of: (i) the criteria of similitude adopted; (ii) the sedimentary material and instrumentation utilized in the models; (iii) the experimental procedure followed; (iv) the quality of the prototype data utilized in verification of the models; and (v) the degree and accuracy of model verification. The scope of this study is limited to those models in which the area of interest is composed entirely of movable material and not of just a thin erodible layer placed over a fixed bathymetry. References (12 items).

Johns, B. The Modeling of Tidal Flow in the Channel Using a Turbulence Energy Closure Scheme. JOURNAL OF PHYSICAL OCEANOGRAPHY, 8(6):1042-1049, November 1978.

A parameterization scheme is developed that is suitable for the modeling of turbulence in marine systems and an application is made to the determination of the tidal structure in an elongated channel. The model is used to investigate the practicality of the frequently employed depth-integrated technique and conclusions are drawn about the customary bottom stress parameterization inherent in that approach. Additionally, it is shown that the value of the roughness length of the elements at the floor of the channel is of importance in determining the frictional dissipation in the model and an evaluation is made of the tidally induced residual flow in the channel. References 10 items).

Kabbaj, A., and Le Provost, C. Nonlinear Tidal Waves in Channels: A Perturbation Method Adapted to the Importance of Quadratic Bottom Friction. (See complete entry in Section I.)

Kato, M., and Wada, A. Adaptability of Prediction Method of Hydraulic Model Experiment for Thermal Diffusion. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3082-3096.

In this paper the loci of tidal current, the horizontal turbulence of mesoscale and far field temperature distributions obtained in the three hydraulic models having different distortion rates are compared with those of field measurements in prototype. The selected site as prototype is Takasago Point located in the northeastern part of Harima of the Seto Inland Sea, where there are two thermal power stations in operation adjacently. From these results, some problems of adaptability for the

technique of distorted hydraulic model experiment for predicting the diffusion extent of thermal discharge are discussed. References (3 items).

Kendrick, M.P., and Derbyshire, B.V. Factors Influencing Estuary Sediment Distribution. (See complete entry in Section II.)

Kjeldsen, S.P. Algorithm for Vertical Diffusion. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3189-3207.

A mathematical method and a computer algorithm is developed for the case of one-dimensional vertical mixing for an estuary with rather small advection. In the case under consideration the diffusion coefficient varies with time and depth, and the case is therefore closer to actual estuaries than earlier computing methods that apply constant coefficients. Model experiments with a small grid oscillation with high frequencies in two fluids with different densities were performed to test the algorithm. The results showed that the ratio between the stabilizing Brunt-Vaisala frequency and the agitating cyclic frequency was a governing parameter for the system, and dimensionless diffusion coefficients could be expressed as a function of this parameter. References (1 item).

Kluth, D.J., and Ackers, P. A Mathematical Model of the Closure Problem and Permanent Operation for Tidal Power Studies. In: Proceedings, Seventeenth Congress of the International Association for Hydraulic Research, August 15-19, 1977, Baden-Baden, Federal Republic of Germany, 4(Subj.C):1-8.

The closure problem is the selection of a practicable and economic method and sequence of building an impounding structure across an existing tidal channel. The tidal flow and velocity depend on the waterway area, energy losses, sea level, basin storage, and upland inflow to the basin. Incremental closure of the channel when building the impounding structure affects the waterway area, changes the flow and velocity, and promotes a differential water level across the structure. These hydraulic effects can influence the choice of building method (e.g. in situ construction or floated-in caissons, rockfill, or sandfill). The correct choice of building sequence minimizes adverse hydraulic effects. A mathematical model is essential in studying alternative methods and sequences of closure for the wide ranges of tidal levels and waterway openings likely to be involved. Such a model was used for the study of a tidal power scheme at Secure Bay, Western Australia. The program outputs include flows and velocities through each available opening, water levels, and (where appropriate) energy generation. References (4 items).

Knight, D.W., and Ridgeway, M.A. An Experimental Investigation of Tidal Phenomena in a Rectangular Estuary. In: Proceedings, International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle-Upon-Tyne, England, April 12-15, 1976, B3-25-B3-40.

This paper describes an experimental study of long wave propagation in an idealized estuary. The laboratory tidal model consisted of a parallel sided horizontal channel of rectangular cross section, closed at one end and open at the other to an oscillating sea. This represents the simplest possible estuary configuration with no fluvial input. The boundary roughness of the tidal channel was varied and the resistance coefficients determined experimentally under steady flow conditions. For each boundary roughness the estuary was operated over a wide range of tidal conditions. This paper presents the results of this experimental work, and considers it alongside various analytical and numerical models commonly used to describe tidal phenomena. The rise and fall of the water surface elevation at various positions along the estuary are evaluated over a range of tidal and roughness conditions, and the results compared with explicit and implicit finite difference model solutions. The amplitude and phase lags within the estuary are compared with the second order analytical solution by Proudman, and also with the solution by Ippen to the classical Telegraphers equation with linearized resistance. The importance of various dimensionless parameters is demonstrated. References (11 items).

Krause, G. Physical Processes in Tidal Estuaries in Relation to the Monitoring of Water Quality. (See complete entry in Section III.)

Kristof, R.C. The Role of Physical Modeling in the Mathematical Modeling of the Sacramento-San Joaquin Delta. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K.B. Macdonald, New York, Plenum Press, 1980, 285-297.

In order to define the salinity-outflow relationship, efficiently operate existing facilities, and evaluate the benefits of proposed facilities, a number of hydraulic and water quality models have been developed, including two physical models, three analog models, and several mathematical models. The number of models that have been developed is in itself a statement of the complexity of the system. Controversy often arises over whether it is best to use a mathematical model or the physical model. Each approach has certain advantages over the other and the selection of the appropriate method is entirely dependent on the circumstances of the situation to be modeled. However, there are also situations in which the best approach may be to use a synergistic combination of both mathematical and physical models. The purpose of this paper is to illustrate this technique. References (4 items).

Kuo, A.Y., and Jacobson, J.P. Prediction of Pollutant Distribution in Estuaries. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3276-3294.

A method was developed for predicting the distribution of sewage constituents which would result from a proposed sewage outfall in estuaries or coastal seas. The method is based on the mathematical relationship between the solutions of the mass-balance equations with and

without a decay term and on the assumption that both the dispersion and decaying processes are linear, acting independently. The application of the method requires dye dispersion experiments and a numerical model employing the results of the experiments. This approach makes it possible to predict the concentration field of sewage constituents with differing decay rates by using tracer release experiments employing a conservative tracer. The method has been applied to assess the environmental impact of a proposed sewage outfall in Hampton Roads, Virginia. Two dye dispersion experiments were performed, one a continuous release over a flood tide cycle and the other over an ebb tide cycle. Horizontal distributions of dye were measured at subsequent slack waters before flood and ebb. References (9 items).

Lai, C. Some Computational Aspects of One- and Two-Dimensional Unsteady Flow Simulation by the Method of Characteristics. (See complete entry in Section I.)

Larsen, L.H. Dispersion of Passive Contaminant in Oscillatory Fluid Flows. (See complete entry in Section III.)

Leatherman, S.P., ed. Barrier Islands: From the Gulf of St. Lawrence to the Gulf of Mexico. (See complete entry in Section I.)

LeBlond, P.H. On Tidal Propagation in Shallow Rivers. (See complete entry in Section I.)

Leendertse, J.J., and Liu, S.K. State Estimation of Estuarine Circulation and Water Quality by Numerical Simulation and Observation. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3223-3242.

The paper describes a hindcast of postrainstorm coliform bacteria distributions in Jamaica Bay made by use of a water-quality simulation model of that bay and models of the surrounding drainage basins on the basis of tide, wind, and rainfall data. That hindcast is then compared with coliform estimates obtained by field sampling. Although the investigators did not have access to the results of the field sampling until the hindcast was completed, the estimates obtained by simulation agree well with the estimates from field data. It in concluded that the models used here are capable of making predictions for engineering assessments. References (10 items).

Leendertse, J.J., and Lui, S.K. Three-Dimensional Flow Simulation in Estuaries. In: Proceedings, International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle-Upon-Tyne, England, April 12-15, 1976, B2-11-B2-24.

The model described in this paper is based upon numerical integration of the flow equations which simulate the water movements caused by tides, wind, and pressure differences and upon numerical integration of the advective diffusion equation representing the movements of salt and temperature. The model neglects vertical accelerations, but not vertical velocities, and includes an approximation for the subgrid scale effects by introduction of mass and momentum exchange coefficents. These coefficients are dependent upon the Richardson number and vertical velocity gradients. The computation method is tested on an estuary and the results of the simulations are presented in graph form. References (5 items).

Leendertse, J.J., and Nelson, A.B. A Water-Quality Simulation Model for Well Mixed Estuaries and Coastal Seas: Volume IX, The Computer Program. Rand Corporation, R-2298-RC, April 1978.

This program reflects the detailed descriptions given in Volume II of the report series. No reflections in the method of computation were made for the experiments described in subsequent reports. The model as presented is not a generalized model which can be used for a certain class of estuaries and coastal seas; it is limited in its boundary conditions, and changes are required if the model boundary is not on the left side of the model array. The program in its present form can be used to compute the flow and pollutant distributions in a certain region if certain conditions are met. The area for which the simulations are made is covered by a two-dimensional grid on a horizontal plane. All descriptions of spatially varying parameters and of all variables are made on this grid. The data input is divided into three sections--control data for the computation, array values for system initialization and control, and time-varying inputs.

Lepetit, J.P., and Moreau, S. Study of an Artificial Island. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3526-3535.

The effect of an artificial island on swell and shore stability and the calculation of pollutant dispersion are approached by the use of mathematical models; the effect of the island on tidal currents is analyzed on a reduced scale physical model.

LeProvost, C., Rougier, G., and Poncet, A. Numerical Modeling of the Harmonic Constituents of the Tides, with Application to the English Channel. JOURNAL OF PHYSICAL OCEANOGRAPHY, 11(8):1123-1138, August 1981.

An in-time spectral, finite-element method is proposed for modeling the main astronomical and nonlinear constituents of the tide in any oceanic or shallow-water area. The classical nonlinear hyperbolic problem for long waves is transformed to a set of elliptic modal problems by looking at a multiperiodic solution with basic frequencies deduced from the tide-generating potential development. The method is based on a perturbation technique. Because of the nonanalytic formation of the quadratic bottom friction, a multiperiodic development of these terms is needed. This is realized under a restrictive hypothesis that a dominant wave is present in the studied tidal spectrum. Although the damping terms of friction deduced from this development are of second order, their influence on the real solutions is very important. Thus, a quasi-linearization of

these damping terms makes possible a computation of damped solutions, as soon as the first order of approximation, for each wave investigated. Practically, for each order of approximation and each significant frequency, we have to solve a second-order equation of the Helmholtz type, which is possible to write under a variational formulation. A finite-element method is used for the numerical integrations. First, an illustration of the method is presented for the academic case of a wave propagating in a rectangular rotating channel together with its first harmonic produced inside the basin by nonlinear processes. Then a practical application is presented with the computation of some of the main constituents of the tide in the English Channel: the dominant wave M_2 and its first harmonic M_4, and two astronomical constituents, the semidiurnal S_2 and the diurnal K_1. The possibilities offered by the finite-element procedure used appear very attractive for practical investigations of oceanic and shallow-water tides. The computing time requirements are small. References (29 items).

Levesque, L., Murty, T.S., and El-Sabh, M.I. Numerical Modeling of Tidal Propogation in the St. Lawrence Estuary. INTERNATIONAL HYDROGRAPHIC REVIEW, 56(2):117-132, July 1979.

A two-dimensional numerical model is developed to study the tidal propagation in the St. Lawrence Estuary. Linearized vertically integrated equations of motion and continuity are used. Central finite difference scheme is used both in space and time (forward differences for the dissipative term) and conjugate Richardson lattice scheme is used to ensure conputational stability. In this model, the independent tides as well as water level variations due to meteorological causes are omitted. Hence the direct tidal forcing term is set to zero, and the observed tidal constituent is specified at the mouth of the estuary. Separate runs are made for each of the five important tidal constituents in the estuary, namely M_2, S_2, N_2, K_1, and O_1 and also for the total tide. Coamplitude, cophase lines and tidal current ellipses are constructed for each of the five tidal harmonics. Comparison of the model results with previous work and shore based gauge observations shows that the model gives good agreement and can be used to interpret tidal propagation in the St. Lawrence Estuary. References (14 items).

Liu, S.-K., and Leendertse, J.J. A Three-Dimensional Model for Estuaries and Coastal Seas: Volume VI, Bristol Bay Simulations. The Rand Corporation, R-2405, September 1979.

The report presents the simulation of tide and wind effects in St. George Basin and Bristol Bay, which are part of the Eastern Bering Sea. The primary purpose of the model development is to establish a basis for predicting oil spill trajectories and for risk analysis of the proposed oil lease areas within this coastal sea. The currents in this area are strongly tide-dominated and consistently nonhomogeneous, thus requiring a three-dimensional model to resolve the vertical distribution of energy density and shear stress gradient. This report presents the procedure for model setup, adjustment, and verification. During the model adjustment stage, field data are used to determine the appropriate bottom stress coefficients and the constants for the turbulence-closure computation. The vertical momentum and mass-heat diffusion are evaluated by the subgrid scale turbulent energy intensities; the horizontal diffusion is evaluated by the grid scale and the deformation of the local velocity field. For the model's verification run, predicted tides at the open boundaries are used to drive the model. The computed current distributions are then compared against the observed values so that the model's predictability can be evaluated. Excellent agreements are found for stations where field data are available. It is therefore concluded that the model forms a good basis for predicting the responses of the bay system under forces induced by wind, tide, and local density variations. References (13 items).

Liu, S.-K., and Leendertse, J.J. Multidimensional Numerical Modeling of Estuaries and Coastal Seas. ADVANCES IN HYDROSCIENCE, 11:95-164, 1978.

The article deals primarily with recent progress made in the area of multidimensional numerical modeling of hydrodynamic and water-quality processes in estuary and coastal sea systems. It consists of five major sections: Section II deals with the basic governing equations of hydrodynamic behavior; the transport and diffusion of heat, salt, and dissolved constituents; and turbulent energy for estuaries and coastal sea systems. Section III discusses three different types of numerical models for the modeling of vertically well-mixed two-dimensional hydrodynamic and water-quality systems. An implicit finite-difference scheme and other models derived from it are introduced first. An explicit finite-difference method and other similar models are than given, following by a brief discussion of finite-element analysis and the method of characteristics for solving a similar set of governing equations. Also given in this section are aspects of energy transfer, model adjustment, and verification. Methods for assessing the impact of man-made structures on the tidal circulation in an estuary system after the adjustments are made are also given. To illustrate the model design procedures described in this section, a case history involving Jamaica Bay, New York, is presented. Section IV deals with three types of models for the modeling of three-dimensional flow systems. The multilayered type of model is described, as well as the multileveled modeling approach. Computational aspects are also discussed, and the iterative scheme (i.e., the Marker and Cell approach) and the direct solution approach are compared. In Section V, problems associated with prescribing open boundary conditions for coastal models are discussed A recently developed "network response function" method is described. In Section VI, a general discussion on the important aspects of numerical model design is given. Considerations such as the problem of numerical instability, the phenomenon of discontinuity, and the conservation aspects are dealt with in some detail. References (103 items).

Machemehl, J.L., Bird, N.E., and Chambers, A.N. Tidal Inlet Flow Dynamics and Sediment Movement. (See complete entry in Section II.)

Mantz, P.A., and Wakeling, H.L. Forecasting Flood Levels for Joint Events of Rainfall and Tidal Surge Flooding Using Extreme Value Statistics. (See complete entry in Section I.)

Mariette, V., et al. Tidal Currents in the Mer d'Iroise. (See complete entry in Section I.)

Mason, C. Functional Design of Tidal Entrance Structures for Effective Navigation and Channel Stability. (See complete entry in Section V.)

Mayor-Mora, R.E. Laboratory Investigation of Tidal Inlets on Sandy Coasts. US Army Corps of Engineers, GITI Report 11, April 1977.

Experiments were conducted on a fine sand barrier separating two 1-foot-deep basins representing an ocean and a bay. Pilot channels with varying geometric characteristics were cut through the barrier to communicate the basins and thus create an ocean-inlet-bay system subsequently subjected to ocean tide and wave action. Measurements were made of cross-sectional areas; water-surface elevations at ocean, bay, and inlet; and inlet current velocities for a number of cycles (sinusoidal tides) until the water-surface fluctuations in the bay become periodic for each run. Exploratory studies included runs with jettied inlets, a run with freshwater inflow into the bay, inlets under mild and steep ocean waves, and runs to determine the effect of model bed ripple orientation on the friction coefficient of the inlet channel. Experimental data are presented and compared to the basic theoretical solution of the problem of Keulegan and to an extension of the Keulegan theory (the lumped parameter approach) developed by Huval and Wintergerst. References (14 items).

McDowell, D.M. Modelling Methods for Unsteady Flows. In: Proceedings of the International Symposium on Unsteady Flow in Open Channels, held at University of NewCastle-Upon-Tyne, England, April 12-15, 1976, B1-1-B-1-10.

Physical and numerical modelling of the shallow-wave equations are described and compared. The physical basis of each is derived from the equations of motion and the capabilities and limitations of each method are discussed. Scale effects in physical models are demonstrated. The present state of the art of numerical analysis is described. Possible applications of each method considered and presented in a summary table are tidal propagation, net water movement, net solute movement, sediment transport, and engineering problems including barrage, reclamation, training schemes, dredging, and circulation of water and pollutants. References (15 items).

McDowell, D.M. Numerical Solution of Tidal Problems. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 8, 1973

Numerical solutions to tidal problems in estuaries are presented. Both implicit and explicit methods of the finite-difference method are given. The solution scheme is discussed in terms of two main criteria, stability and accuracy, which it should satisfy. References (5 items).

McDowell, D.M. The Usefulness of Finite-Difference Methods in Estuarine Modeling. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Lecture No. 14, 1973. References (9 items).

Mizumura, K. Prediction of Water Level in Tidal Inlet. Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings, ASCE, 108(WW1):97-106, February 1982.

A very important and difficult problem is operation of gates at the inlet of tidal lakes in order to control water quality and quantity. The gate operation must sufficiently satisfy both flood control and irrigation. As the first step to optimize a gate control, the water levels downstream of the gate are predicted by a combined model using regression theory and control theory. The prediction model consists of two parts. A regression equation is used to predict the water levels downstream of the gate by the sea levels. A Kalman filtering algorithm is employed to identify parameters used to construct the state equation in the second part. This method is applied to the prediction problems of water levels on the downstream side of the gate at the inlet of Lake Kahokugata, Ishikawa, Japan. It is possible to predict the fluctuations of the water levels under the arbitrary gate operations one or two hours ahead of time. The Kalman filtering algorithm with the first and second order Markov models are studied. References (10 items).

Mungall, J.C.H., and Matthews, J.B. The M_2 Tide of the Irish Sea: Hourly Configurations of the Sea Surface and of the Depth-Mean Currents. (See complete entry in Section I.)

Najarian, T.O., Thatcher, M.L., and Harleman, D.R.F. C & D Canal Effect on Salinity of Delaware Estuary. (See complete entry in Section V.)

Nakagawa, H., and Suzuki, K. Local Scour Around Bridge Pier in Tidal Current. (See complete entry in Section II.)

Nece, R.E., Falconer, R.A., and Tsutsumi, T. Planform Influence on Flushing and Circulation in Small Harbors. (See complete entry in Section IV.)

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients. (See complete entry in Section IV.

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. (See complete entry in Section I.)

Noye, J., May, R.L., and Teubner, M.D. Three-Dimensional Numerical Model of Tides in Spencer Gulf. OCEAN MANAGEMENT, 6(2/3): 137-147, January 1981.

Few mathematical methods are available for determining the three-dimensional description of sea circulation due to external tide forcing. Most of these methods can be applied only where the maximum variation of the sea surface about mean sea level is small compared to the sea depth. A new method of calculating the three-dimensional tidal currents and the tide heights has been applied to Spencer Gulf, South Australia. The method applies to the very shallow waters at the head of the gulf, where the tidal range is not small compared with the depth of the sea, as well as the deeper waters near the mouth of the gulf. References (16 items).

Nystrom, J.B., Hecker, G.E., and Moy, H.C. Heated Discharge in an Estuary: Case Study. Journal of the Hydraulics Division, Proceedings, ASCE, 107(HY11):1371-1406, November 1981.

Two physical model studies were conducted to evaluate the thermal patterns produced in the Hudson River by the condenser cooling water discharge from the Indian Point Nuclear Generating Station. Model similitude criteria are developed and applied to the Indian Point site to determine model scale ratios. Model construction, verification, and operation techniques are described. Typical results show surface temperature rise patterns near the plant discharge and within a 15-mile reach of the river. Sensitivity of thermal patterns to variations in freshwater runoff, plant load, and discharge structure geometry are illustrated. Model results are evaluated with respect to scale effects, and limitations due to inability to simulate certain phenomena occurring in the field. Model results are compared to an extensive field survey program and one-dimensional time-averaged mathematical model. References (20 items).

O'Conner, B.A., and Thompson, G. A Mathematical Model of Chloride Levels in the Wear Estuary (UK). In: Proceedings, International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle-Upon-Tyne, England, April 12-15, 1976, H1-1-H1-12.

The present paper describes a computational procedure which can be used to study the real-time dispersion of pollutants in well mixed and partially mixed estuaries given details of the river flow rate, the estuary geometry, the pollutant inflow rate and its decay, and appropriate boundary conditions. The procedure was used to study the particular problem of salt intrusion upstream of a partial tidal barrage which was to be constructed on the Wear estuary (UK). The solution procedure produces cross-sectional tidal flows and water-surface elevations via an explicit finite-difference solution of the governing fluid momentum and continuity equations. The flow and geometric information is then used in a Galerkin finite-element solution of the salt continuity equation in order to determine estuary chloride levels. The calculation procedure makes use of a large digital computer and was applied to existing conditions in WEAR estuary and shown to be capable of reproducing field observations provided appropriate friction and dispersion parameters were used. The effect of the tidal barrage was studied by including appropriate weir discharge relationships into the hydrodynamic calculations. The use of a low, fixed crest level barrage was shown to result in the buildup of salt upstream of the barrage at commonly occurring low freshwater flow rates. The computational procedure was found to be most useful in examining a large number of alternate modes of barrage operation so that upstream water extraction could be safeguarded against chloride contamination. References (7 items).

Officer, C.B. Box Models Revisited. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 65-114, 1980.

A methodology in terms of box models has been reexamined for the investigation of conservative and nonconservative quantities in estuaries. Both one and two dimensional models and both tidal exchange and circulation effects are included. Various types of loss relations, sources and sinks, and vertical exchanges are considered. The box model results are tested against analytic solutions of the same problems where available and against two more refined, hydrodynamic numerical model results for a nonconservative loss problem and for a suspended sediment distribution. The required inputs are salinity, estuary geometry, and river flow, which are often known quantities. There are no undetermined or undefined hydrodynamic coefficients. In each case the relations are given by a set of linear algebraic equations. They can be solved by computer matrix algebra procedures or because of their particular form by successive approximations with a hand calculator. The methods presented do not pretend to add to our physical oceanographic knowledge of estuarine circulation, mixing, and the like. It is, however, hoped that they may be of use to those examining biological, chemical, engineering, and geological distributions, transformations and other effects, which depend, in part, on estuarine hydrodynamics for their explanation. References (39 items).

Officer, C.B. Discussion of the Turbidity Maximum in Partially Mixed Estuaries. (See complete entry in Section II.)

O'Kane, J.P. Estuarine Water-Quality Management with Moving Element Models and Optimization Techniques. Boston, Pitman Publishing, Limited, 1980. 155p.

The principal objective of the study was to explore the engineering-economic problem of the disposal of biodegradeable liquid waste which originates around an estuary. Two interdisciplinary problems requiring a knowledge of water chemistry, hydrodynamics, and optimization techniques were presented: (1) minimize the cost of abatement (piping and treatment), over all sources of waste, subject to the constraint that the maximum depleting of oxygen be at a prescribed level and (2) minimize the maximum oxygen response of the estuary subject to a fixed budget. Dissolved oxygen was used as the water-quality parameter. The water chemistry and

hydrodynamics were combined in a moving element body while the optimization was based on discrete marginal analysis. A very simple water-quality model was found, namely a pair of ordinary differential equations subject to two-point boundary conditions on an oscillating reference frame, one for oxygen demand, the other for oxygen. Only a theory of bounds requires less computation but is unsuitable for imbedding in the lease cut optimization problems. A unified theory for solute concentration in one-dimensional estuaries was created while demonstrating that this simple model was a very acceptable approximation to the more complex model based on a pair of partial differential equations under quasi-steady conditions. A very simple optimization technique was developed for finding tight bounds on the whole cost-effectiveness function for both treatment and piping. References (113 items).

Ozturk, Y.F. Mathematical Modeling of Dissolved Oxygen in Mixed Estuaries. Journal of the Environmental Engineering Division, Proceedings, ASCE, 105(EE5):883-904, October 1979.

One of the basic difficulties in modelling dissolved oxygen (DO) in a given estuary is the uncertainties involved in the biochemical oxygen demand (BOD) and reaeration rates. The oxidation of both carbonaceous and nitrogenous substances simultaneously and their representation by first-order kinetics may be justified in estuaries. The carbonaceous and nitrogenous BOD rate coefficients have been determined from the standard BOD tests of estuary water samples by considering the two stages of BOD separately and by adjusting the time origin of nitrification stage. The available reaeration rate coefficient equations developed for nontidal systems and applied in modeling DO in tidal estuaries do not fully represent the tidal estuaries. A new reaeration rate coefficient equation has been developed for tidal systems. The proposed equation is related to the dispersion coefficient and is a function of flow depth and four-thirds power of tidal velocity. References (23 items).

Parker, G.C., Fang, C.S., and Kuo, A.Y. Thermal Discharges: Prototype vs. Hydraulic Model. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3049-3067.

Data on physical parameters in the James River around the condenser cooling water discharge of the Surry Nuclear Power Plant, taken prior to and during plant operation, were analyzed to determine the physical effects of the thermal discharge on the area and to compare the prototype distribution of excess temperature to predictions based on hydraulic model experiments. The results of this investigation indicated that the increase in water temperatures due to the thermal discharge did not represent a significant alteration of the physical environment outside the mixing zone. The thermal discharge experienced turbulent mixing and entrainment near the outfall and temperatures decreased rapidly in this region. Field data on temperature distributions around the discharge, when compared to predictions based on hydraulic model experiments, indicate that the model predictions were conservative. References (4 items).

Parthiot, F. Development of the River Seine Estuary: Case Study. Journal of the Hydraulics Division, Proceedings, ASCE, 107(HY11): 1283-1301, November 1981.

A movable-bed scale model of the Seine estuary in France was originally developed more than 30 years ago to study the means of stabilizing the main shipping channel. This is a detailed account of how the model was designed, built, calibrated, and operated, to provide valuable information for design of the channel training works completed in 1963. After this first success, a new version of the model was built in 1967, with certain detailed changes, and has continued serving for studies of development works in the estuary to the present day. Hydraulic and sedimentological characteristics of the estuary are described, as well as the model design criteria which led to the choice of scales and bed material. Other modelled features are waves, tides, and offshore current. The calibration tests included the successful reproduction of the natural evolution of the estuary observed over a period of almost 100 years. The conclusion shows how optimum efficiency can be achieved by using a mathematical model of estuary tides and currents in combination with a moveable-bed scale model. References (10 items).

Permanent International Association of Navigation Congresses. Improvement and Maintenance of Navigation Channels and Control of the Regime in Estuaries in Relation to the Energy Due to Tidal Movement, Waves and Swell at the Entrance. (See complete entry in Section V.)

Posmentier, E.S., and Raymont, J.M. Variations of Longitudinal Diffusivity in the Hudson Estuary. (See complete entry in Section I.)

Pratte, B.D. Churchill River Salt Water Tidal Model. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3445-3459.

The Churchill River will soon have much of its flow diverted into the Nelson River several hundred miles upstream for power development. The effect of severely reduced flows on conditions in the harbor was investigated. The drag-plate current meter velocities over two semidiurnal tide cycles, for two test conditions, one with present average riverflow of 50,000 cfs, and the other for an admittedly very small discharge of only 2,500 cfs, are shown. These two tests demonstrate the effect of a reduction in riverflow. The high water levels at the dock are influenced mainly by Hudson Bay and so were found to be almost the same. The low water, however, is about 0.6 foot lower with the small flow since only a small slope is then required to get this amount of fresh water out to Hudson Bay. Water levels further upriver are lowered dramatically, so that the river becomes much narrower and shallower. The velocity meters showed interesting behavior. Meter 51 was in the entrance in the surface layer and meter 59

was directly below it near the bed. With the 50,000-cfs flow, there was a 2.5-hr lag between the time the bottom seawater (59) began to move as inflow and the time when the surface layer (51) finally reversed also. However, with the 2,500-cfs riverflow, the surface layer is so thin that virtually the whole flow reverses direction at the same time. The tidal prism of the estuary which at high flows is filled by river and tide, will then be mainly filled by inflow from Hudson Bay. Thus inflow times will be longer and the velocities higher, and outflows will be shorter. The end result will be more time for littoral drift sediments to be carried into the estuary, and less time to be cleared out. On the favorable side of the question of reduced river discharges is the fact that less riverflow will bring down less sand and sediments. In addition, less ice should be produced in the rapids by the smaller river cross section. These two factors may well more than compensate for the increased siltation expected from Hudson Bay. References (2 items).

Priessmann, A. Use of Mathematical Models. In: Proceedings of the International Symposium on Unsteady Flow in Open Channels, held at University of Newcastle-Upon-Tyne, England, April 12-15, 1976, E3-23-E3-28.

Reliable computional methods for the simulation of nonstationary flow in canals and rivers have now been available for about twenty years, and mathematical models have been found adequate for quite a large number of applications. The time has now come to make a general assessment summary of investigations to date and to concentrate on problems to which no satisfactory solution yet appears to have been found. Reference is made to the following points in this connection: (1) Comparison between the mathematical model (integration of Saint-Venant equations) and simpler general methods (kinematic waves, Muskingum, and other similar methods, etc.), respective advantages and drawbacks, and cases to which simpler methods can be applied without overlooking hidden effects of basic phenomena. (2) The importance of density in calculating wide wave propagation in estuaries and tidal rivers, and effect on vertical velocity distribution. Possible methods of approach. (3) Bed variation problems: their various aspects, especially as regards head loss variation as depending on various forms of sediment drift (dune or bank formation, etc.).

Redfield, A.C. The Tide in Coastal Waters. (See complete entry in Section I.)

Redfield, A.C. The Tides of the Waters of New England and New York. (See complete entry in Section I.)

Renger, E. Quantitative Geomorphological Analysis of Erosional Topography with Respect to the Morphology of Tidal Basins. In: Proceedings, Seventeenth Congress of the International Association for Hydraulic Research, August 15-19, 1977, Baden-Baden, Federal Republic of Germany, 4(Subj.C):205-212.

The geomorphological macrostructure of hydrologically influenced catchment areas, such as tidal basins and drainage basins have precisely determined spatial structures (distributions). But stability studies of these natural gully systems which, in general, contain a large number of branches, first demand a regime-oriented analysis and a characteristic quantification of the values. For this purpose a "two-dimensional hypsometric analysis" was carried out for the first time for tidal basins in the German Bight/North Sea. It was possible to create relative form parameterization dependent on the location by means of a two-dimensional natural system of coordinates (s = gully length coordinate, z = elevation). Here the analysis is carried out separately in a vertical and in a horizontal direction. The calculated distribution functions show characteristic distribution features, and these are suitable for use as reference values for dimensionless model functions, as well as for the wider comparison of similar basins. An empirical two-dimensional geomorphological model function has been developed for the vertical volume structure on the basis of a simple exponential approach. References (8 items).

Roberts, P.J.W. Current Measurements and Mathematical Modeling in Southern Puget Sound. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 269-284, 1980.

Field observations and mathematical modeling were conducted in order to understand the circulation patterns in Nisqually Reach, Southern Puget Sound. Eight continuously recording current meters at four sites and a two-dimensional finite element model were used. Analysis of the current data showed the currents to consist of a first principal component which was essentially parallel to the channel walls. This component was primarily tidal, although both high and low frequency content was apparent. The high frequency content was attributed to fairly small-scale turbulence. The low frequency currents exhibited fluctuations on the order of several days, with the power spectra showing a secondary peak at 2.5 days. These low frequency fluctuations are probably due to wind effects, occurring both locally and nonlocally. Typical circulation patterns predicted by the mathematical model are presented. The model reasonably reproduces the tidal currents but not the high and low frequency content. Other limitations of the model are discussed in light of the analysis of the current meter data. References (9 items).

Robinson, I.S., and Perry, J.M. Tidal Power from Rectangular Estuaries: Tidal Dynamics Constraints Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY11):1915-1934, November 1980.

A one-dimensional analytical model of frictional tidal flow in rectangular uniform section estuaries is presented. The response of different lengths of estuary to given tidal forcing at the mouth is explored to obtain resonance curve, and the linearized friction coefficient appropriate to different tidal amplitudes is indicated A permeable, energy

extracting barrier is introduced and the optimum head/flow ratio is determined for maximum power generation with an ebb/flood operating scheme. Pumped energy storage is introduced by allowing for a complex head/flow ratio and the maximum available net power at optimum design condition is shown to be very much greater than without pumping. The mouth is shown to be the best location. The energy available under various operating constraints, from estuaries of different lengths, is compared with the original energy dissipation in the estuaries. Finally the critical dependence of power output on the choice of barrier flow condition is explored. References (12 items).

Roelfzema, A. Effect of Harbours on Salt Intrusion in Estuaries. (See complete entry in Section III.)

Rohde, H. Sand Movement Investigations by Means of Radioactive Tracers in a Hydraulic Model and in the Field. (See complete entry in Section II.)

Ross, B.E., Anderson, M.W., and Jerkins, P. A Set of Coordinated Mathematical Models for the Coastal Zone. In: Proceedings, 25th Annual Hydraulics Division Specialty Conference on Hydraulics in the Coastal Zone, New York, ASCE, 1977, 11-18.

This paper presents a coordinated set of mathematical models for use in the coastal zone. The models developed utilize consistent methodology of application and consistent form and units of input-output so that each model interfaces with another forming a compatible set. The set of models includes an estuary or nearshore coastal zone hydraulic model which has the capability of simulating various flow boundary conditions such as submerged islands, channels, causeways, etc. Also included in the set as subroutines are an advanced hurricane subroutine, a water quality subroutine, a power plant siting subroutine, and a dredging-sediment transport subroutine. The basic model is supplemented by wave refraction-diffraction and wind driven wave programs. References (15 items).

Sarkkula, J., and Virtanen, M. Modelling of Water Exchange in an Estuary. NORDIC HYDROLOGY, 9(1):43-56.

A two-dimensional horizontal hydrodynamical model has been used to estimate the changes that a harbor road will cause in the water exchange of an estuary. The research area has been the Kokemäenjoki river estuary on the coast of the Gulf of Bothnia in western Finland. The numerical model has been verified on the basis of a regression model describing the water exchange of the estuary at present with a multiple correlation squared of 0.9. The factors having an influence on the water exchange are the wind, the sea level fluctuation, and the river discharge. The changes in the water exchange have been considered during a dry spell, a flood period, and an average year with three different cross-section areas of the road line. The accuracy and reliability of the estimation are found to be very satisfactory. References (9 items).

Scarlatos, P.D. On the Numerical Modeling of Cohesive Sediment Transport. JOURNAL OF HYDRAULIC RESEARCH, 19(1):61-68, 1981.

A one-dimensional finite differences model, based on the dispersion equation with the proper source and sink terms, is used for the prediction of the cohesive sediment transport under simultaneous conditions of erosion and deposition. The validity of the model is verified from actual field data for the Savannah, USA, estuary. References (12 items).

Schwiderski, E.W. Global Ocean Tides, Part I: A Detailed Hydrodynamical Interpolation Model. Naval Surface Weapons Center, Dahlgren Laboratory, NSWC/DL TR-3866, September 1978.

A new hydrodynamical interpolation technique has been developed and tested to construct a model of global ocean tides with the support of empirical tidal constants collected around the world. The discrete tide model features a 1 deg by 1 deg graded grid system in connection with a hydrodynamically defined bathymetry. The Laplace tidal equations are augmented by turbulent friction terms with novel mesh-area (latitude and depth) dependent eddy-viscosity and bottom-friction coefficients. The well-known astronomical tide-generating forces are modified by effects due to solid earth tides and ocean-tidal loading. New averaged finite differences in time are used to enhance stability characteristics and to facilitate the hydrodynamical interpolation of empirical data. This unique interpolation is accomplished by a controlled adjustment of the bottom-friction coefficient and by redefining a more physical shoreline. Extensive computer experiments were conducted to study the characteristics of the novel friction laws and hydrodynamical interpolation methods. The computed M2 tide data along with all (specially labeled) empirical constants are tabulated in map form for four typical 30- by 50-deg ocean areas. A complete tabulation and discussion of the computed M2 tide will be published in Part 2 of this report. It is estimated that the tabulated tidal charts permit a prediction of the M2 tide elevation of the ocean surface over the geoidal level with an accuracy of better than 5 cm anywhere in the open ocean and with somewhat less accuracy near rough shorelines. References (140 items).

Sea Grant Publications Index 1979. (See complete entry in Section I.)

Sengupta, ., Lee, S.S, and Miller, H.P. Three-Dimensional Numerical Investigations of Tides and Wind-Induced Transport Processes in Biscayne Bay. Miami University, Coral Gables, Fla., Department of Mechanical Engineering, Sea Grant Technical Bulletin No. 39, July 1978.

A three-dimensional time-dependent free surface hydrodynamic model was developed, which takes account of topographical and meteorological parameters, for the application to sediment transport and dissolved chemical transport in the South Biscayne Bay. Local tidal effects were introduced into the mathematical model by applying a so-called primitive numerical boundary condition at the ocean-bay interface. Agreement with a statistically

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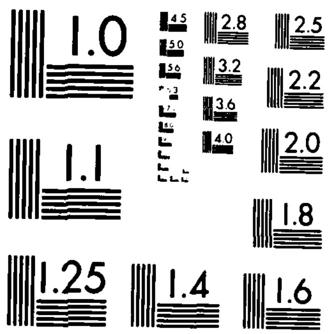

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averaged tide data base, both at the ocean exchange area and at several shoreline locations, for a calibrated model is quite good. Basic sediment transport processes, with associated boundary conditions, were modelled. General features of the suspended particle sediment transport were evaluated qualitatively, and the behavior of the dominant physical mechanisms determined. The model can be directly applied to numerical studies of nutrient, and other processes, as well as to a variety of contaminant transport studies. References (39 items).

Severn Tidal Power. (See complete entry in Section V.)

Seymour, R.J. Longshore Sediment Transport by Tidal Currents. (See complete entry in Section II.)

Sheng, Y.P. Modeling Sediment Transport in a Shallow Lake. (See complete entry in Section II.)

Shigemura, T. Characteristics of Tidal [illegible] on the Pacific Coast of Japan. (See [illegible] entry in Section II.)

Show, I.T., Jr. The Movements of a Marine Copepod in a Tidal Lagoon. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K.B. Macdonald, New York, Plenum Press, 1980, 561-601.

It has been hypothesized that marine copepods are able to react to water movements in an estuary in such a way as to minimize advective losses to the open ocean. This hypothesis is developed mathematically and tested by use of a stochastic model. Several processes are investigated as contributing to the minimization of advective loss. The model treats time-varying spatial patterns of marine plankton. In the present instance, the model is used to describe the movements of <u>Acartia tonsa</u> (Copepoda) in a tidal lagoon on the eastern end of Galveston Island, Texas. Four distinct processes are considered: advection by currents, behavioral response to environmental variables (current velocity, temperature, and salinity fields), intraspecific aggregation, and birth-death processes. The portion of the model dealing with biological processes is a stochastic compartmental model. The biological model is driven by a three-dimensional physical dynamic model which provides numerical solutions for current velocity, temperature, and salinity fields. References (40 items).

Sill, B.L., Fisher, J.S., and Whiteside, S.D. Laboratory Investigation of Ebb Tidal Shoals. Journal of the Waterway, Port, Coastal and Ocean Division, Proceedings, ASCE, 107(WW4): 233-242, November 1981.

The morphology of ebb tidal shoals has received considerable attention in the last few years, but no generally applicable techniques have evolved to predict shoal development. This engineering study is a first step in that direction. Shoals were generated in a laboratory basin and the basin controlling parameters were identified. Results indicate that the inlet behaves as a two-dimensional turbulent jet and that inlet width, discharge velocity, and critical sediment velocity govern the equilibrium shoal dimensions. This preliminary study also suggests that the development of shoal length and width are governed by different transport mechanisms. Resolution of such possibilities requires more detailed studies. References (9 items).

Smith, L.H., and Cheng, R.T. Tidal Stream Flow Solved by Galerkin Technique. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV: 3358-3376.

In this study numerical solutions to the governing equation of a tidal reach have been constructed using a Galerkin finite element approximation in space and finite-difference approximation in time. The computer algorithms have been successfully tested in a case study at Three-Mile Slough, California, where a complete reversal of flow takes place in every semidiurnal tidal cycle. The predictor-corrector solution computes accurate discharges but requires use of the characteristic equations to implement the boundary conditions, and small time steps to maintain numerical stability. The implicit Crank-Nicholson and quasi-linearization scheme has neither of these requirements. Although it requires longer computer time per time step, it permits the use of larger time steps. The total computer time requirements for the implicit and explicit methods are comparable. Good agreement between the measured and computer discharges suggests further applications of the present model to realistic field problems. References (13 items).

Smith, M.R., Reichard, R., and Celikkol, B. Stress and Tidal Current in a Well-Mixed Estuary. (See complete entry in Section I.)

Smith, T.J., and Takhar, H.S. A Mathematical Model for Partially Mixed Estuaries Using the Turbulence Energy Equation. ESTUARINE, COASTAL AND SHELF SCIENCE, 13(1):27-45, July 1981.

A mathematical model describing the vertical structure of a partially mixed estuary has been developed, based on the laterally integrated momentum, continuity, and salt balance equations. The dominant Reynolds stress and the vertical turbulent transport of s lt were modelled by an effective diffusion hypothesis in which the eddy coefficients were determined from the solution of the turbulence energy equation. The effects of density stratification on the turbulence energy, the eddy viscosity, and the turbulent Schmidt number were included. The model was applied to an idealized straight rectangular channel similar in dimensions to the Rotterdam Waterway. The dominant Reynolds stress and the turbulence energy distributions were calculated, in addition to the surface elevation, velocity, and salinity distributions. Observations of an equilibrium turbulence structure near midtide and an inactive component of the turbulence energy were confirmed by the model. The dispersion coefficient was identified as an important parameter in quantifying both the horizontal and vertical structure of the flow and

salinity distributions in laterally integrated representations of partially mixed estuaries. References (54 items).

Snyder, R.M. Tidal Hydraulics in Estuarine Channels. (See complete entry in Section I.)

Stelling, G.S. Improved Stability of Dronkers' Tidal Schemes. Journal of the Hydraulics Division, Proceedings, ASCE, 106(HY8):1365-1379, August 1980.

Stability conditions of Dronkers' explicit finite difference schemes for tidal computations in rivers and open channels are derived. In addition to the CFL condition, more stringent conditions are found. Changing the approximation of the nonlinear terms by applying the "Angled Derivative" method results in a second-order finite difference scheme of the same computational efficiency as a purely explicit scheme for which the only stability condition is the CFL condition. References (9 items).

Storm Tide Warning Service Extends Forecast. (See complete entry in Section I.)

Stout, H.P. Prediction of Oxygen Deficits Associated with Effluent Inputs to the Rivers of the Forth Catchment. (See complete entry in Section IV.)

Stover, J.E., Huston, R.J., and Bergman, W.D. Mathematical Modeling of Thermal Discharge into Shallow Estuaries. TRACOR Document No. T70-AU-7425-U, January 1971.

A mathematical model has been developed for the prediction of water temperature distributions in shallow, vertically well-mixed estuaries, typical of those along the Gulf Coast. The model describes natural temperature variations, both spatial and temporal, as well as temperature variations in the immediate vicinity of a thermal discharge. The model can be used to predict the size of the mixing zone for a given thermal discharge, to define the zone of passage with one or more thermal discharges, to investigate man-made natural modifications at an existing discharge site, to determine the optimum location for cooling water intake and outfall structures, as well as to predict seasonal and diurnal water temperature fluctuations. The development of the mathematical temperature model was conducted in conjunction with the Galveston Bay Project, a comprehensive study of the Galveston Bay estuarine system being conducted by the Texas Water Quality Board. A compatible mathematical hydraulic model, developed as a part of the Galveston Bay Project, was used to obtain the water velocity distribution as a result of tides, wind, discharge from the generating station, streamflow, and the general physiography of the body of water. This current distribution is required as input to the temperature model. The application of the models centered about two sites: Houston Lighting and Power Company's P. H. Robinson Generating Station on Galveston Bay and Central Power and Light Company's Nueces Bay Generating Station. References (57 items).

Suga, K. Unsteady, Stratified Flow with Entrainment by Tides. (See complete entry in Section III.)

Swift, M.R., Reichard, R., and Celikkol, B. Stress and Tidal Current in a Well-Mixed Estuary. (See complete entry in Section I.)

Tamai, N. Friction at the Interface of Two-Layered Flows. (See complete entry in Section III.)

Tee, Kim-Tai. The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model. (See complete entry in Section I.)

Tee, Kim-Tai. The Structure of Three-Dimensional Tide-Generating Currents; Part I: Oscillating Currents. (See complete entry in Section I.)

Tee, Kim-Tai. The Structure of Three-Dimensional Tide-Induced Currents; Part II: Residual Currents. (See complete entry in Section I.)

Tee, Kim-Tai. Tide-Induced Residual Current--Verification of a Numerical Model, JOURNAL OF PHYSICAL OCEANOGRAPHY, 7(3):396-402, May 1977.

In Tee (1976), tide-induced residual currents in the Minas Channel and Minas Basin were studied with a two-dimensional nonlinear numerical tidal model. It was shown that the model could reproduce well the observations obtained in 1960 and 1965. In this paper, further observations obtained in 1974 are presented. The analysed results confirm the calculated tidal and residual currents, and the mechanism that was suggested for the generation of the residual currents. Calculated and experimental results show that the maximum M_2 tidal current occurs earlier in the sheltered areas. References (10 items).

Thakar, V.S., and Bhandary, R.S. Two-Dimensional Mathematical Model of Circulation in Bombay Harbour. IRRIGATION AND POWER, 36(2):201-213, April 1979.

Rapid developments have taken place in recent years in the advanced laboratories of the world, in two-dimensional numerical modelling of hydrodynamic and water quality phenomena. The models aim at digital simulation of wide and shallow water bodies, typically estuaries, bays, and coastal seas, through depth-averaged equations. The outputs are time-varying hydrodynamic and water quality constitutents, such as water levels, component velocities in the horizontal plane, salinity, temperature, biological oxygen demand, dissolved oxygen, coliform, etc. In flexibility, accuracy, and cost-effectiveness, the hydrodynamic numerical model has definite advantages over the physical hydraulic model. In water quality simulation, the numerical model is perhaps the only rational methodology of predictive modelling research. In other fields, the two types of models can play a complementary role. In the present study, tidal circulation in the Bombay harbor is investigated by constructing a model using Leendertse's techniques, modified to suit the available computer, generalized and

extended to include procedures and further analyze the data generated. The investigation aims at a study of the basic techniques with a view to exploit them further for the Bombay harbor, as well as for other problems. A rather crude mesh is employed. The model yields the water levels and velocity components at two-dimensional grid points over a tidal cycle. In its present form, the model is not capable of studying moving boundaries, and is limited only to a study of the hydrodynamic phenomena. Further developmental efforts need to be made at CWPRS to introduce flooding and drying of banks and behavior of water quality. Alternative digital techniques for multidimensional numerical modelling are also being investigated. Reference (1 item).

Townson, J.M., Davies, M.E., and Matsoukis, P. Numerical Simulations of the Bristol Channel Tide. THE INSTITUTION OF CIVIL ENGINEERS, PROCEEDINGS, 69(Pt.2):671:685, September 1980.

Previously reported simulations of the Bristol Channel tides are reviewed. The method of characteristics is applied to x-t and x-y-t representations of the channel itself and to a larger x-y-t space including the Irish coast. The effects of a dead barrage on these tide regimes are described and discussed. References (25 items).

Trawle, M.J. Georgetown Harbor, South Carolina, Report No. 1, Hydraulic, Salinity, and Shoaling Verification; Hydraulic Model Investigation. Miscellaneous Paper H-78-6, US Army Engineer Waterways Experiment Station, Vicksburg, Miss., February 1978.

The Georgetown Harbor model, a fixed-bed model constructed to linear scale ratios of 1:800 horizontally and 1:80 vertically, reproduced a portion of the Atlantic Ocean, Winyah Bay including Mud Bay, North Inlet and marshes between Winyah Bay and North Inlet, the Sampit River including Georgetown Harbor, and the lower portions of the Pee Dee, Black, and Waccamaw Rivers and adjacent marshes. The model was equipped with necessary appurtenances for the accurate reproduction and measurement of tides, tidal currents, salinity intrusion, freshwater inflow, and shoaling distibution. The purposes of the model study were (1) to determine the effects on the hydraulic, salinity, and shoaling characteristics of a deepening from 27 to 35 ft of the main navigation channel to Georgetown Harbor and (2) to determine if present maintenance dredging can be reduced by proposed plans involving channel revisions, sediment traps, and freshwater flow diversion. These studies will be reported in later reports. Model verification tests, presented in this report, were conducted to ensure that the model hydraulic, salinity, and shoaling characteristics were in satisfactory agreement with those of the prototype. The agreements attained between model and prototype were considered satisfactory for the types of tests conducted in the model.

Vincent, C.E. The Interaction of Wind-Generated Sea Waves with Tidal Currents. (See complete entry in Section I.)

Vollmers, H. Harbour Inlets on Tidal Estuaries. (See complete entry in Section II.)

Vollmers, H. Tidal Models with Movable Beds. Lisbon, NATO Advanced Study Institute on Estuary Dynamics, Seminar No. 2, 1973.

The study points out the successful reproduction of morphological occurrences in a tidal estuary. The evaluation of the different construction plans of the training wall extension shows an optimum for the tangential lengthening (Test II), that means a minimum dredging rate for the "Center Channel," as the main navigation channel in the Elbe-river estuary. Measured quantitative shoaling rates were used only as a qualitative comparison basis. It is impossible to reproduce all natural phenomena complexities in a model, but in many instances, these models are a valuable help for the estimation of constructional or dredging works in coastal areas. References (7 items).

Waldrop, W.R., and Farmer, R.C. A Computer Simulation of Density Currents in a Flowing Stream. (See complete entry in Section III.)

Wang, D.-P. Observation and Modeling of the Circulation in the Chesapeake Bay. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 35-48.

In recent years, our understanding of circulation in the Cheseapeake Bay has been greatly improved through long-term current meter measurement, and sophisticated numerical modeling. The circulation mainly consists of tide, river, density, and wind-driven flow. The tidal current has larger amplitude, and is mainly responsible for the mixing and sediment resuspension. On the other hand, because of its longer duration, the nontidal current determines the transport of salt, sediment, and pollutant. Vertical variations of the salinity and velocity distribution play the most important role in mixing and transport. Therefore, vertical dimension has to be included in the circulation model. By adapting the semi-implicit and mode-split method, efficient two-dimensional (in a vertical plane) and three-dimensional models have been developed, which reduce the computer time by orders of magnitude. Effective numerical modeling, coupled with sound observational basis, is crucial to the understanding of mixing and transport in a partially mixed estuary. References (14 items).

Wang, D.-P., and Kravitz, D.W. A Semi-Implicit Two-Dimensional Model of Estuarine Circulation. JOURNAL OF PHYSICAL OCEANOGRAPHY, 10(3):441-454, March 1980.

A semi-implicit, two-dimensional (in a vertical plane) model is developed for circulation in the partially mixed estuary. Comparisons between the semi-implicit and explicit method are made in the simulation of tidal, wind-driven, and density-driven circulations. In general, the two model results are in good agreement in velocity and density computation; the semi-implicit method, however, fails to simulate the surface seiche oscillation. On the other hand, the semi-implicit method is more efficient; depending on the horizontal space resolution, the semi-implicit method can result in orders of magnitude saving in

computer time. Application of the semi-implicit model to the Potomac River indicates large longitudinal and vertical changes in tidal, density-driven, and wind-driven circulations, which suggests that two-dimensional (in a vertical plane) modeling is essential in the transport and mixing study. References (20 items).

Wang, J.D. Finite Element Model of 2-D Stratified Flow. Journal of the Hydraulics Division, Proceedings, ASCE, 105(HY12):1473-1485, December 1979.

A finite element model for the study of hydrodynamics and salt transport in partially mixed estuaries is presented. The model is based on the laterally integrated time varying equations of motion, continuity, and conservation of salt. The Boussinesq approximation is applied to the resulting two-dimensional equations and a simple equation of state is used to relate salinity to density. Although a rigorous mathematical proof cannot be given it is heuristically postulated that the correct boundary conditions, defining a well-posed problem, must consist of applied stresses or strain rates in cases with internal (Reynolds) stresses included. Without the internal stresses the pressure of the normal strain rate only can be prescribed. A simple application demonstrates the ability of this model to accurately represent the moving surface. Another example illustrates the significance of ocean boundary conditions on the internal solution. References (11 items).

Wang, Y.H. Determination of Interfacial Eddy Diffusion Coefficient of Highly Stratified Estuary. (See complete entry in Section III.)

Wang, Yu-Hwa. Salinity Distribution of a Highly Stratified Estuary. (See complete entry in Section III.)

Ward, G.H., Jr. Hydrography and Circulation Processes of Gulf Estuaries. (See complete entry in Section I.)

Warluzel, A., and Benque, J.P. Dispersion in a Tidal Sea. (See complete entry in Section I.)

Wave and Tidal Energy; Second International Symposium on Wave and Tidal Energy, BHRA Fluid Engineering, Cranfield, 3edford, England, 23-25 September 1981.

Partial contents: One-Dimensional Modelling of Tidal Power Schemes by D. C. Keiller and G. Thompson. Mathematical Modelling of Tidal Power Schemes in the Bristol Channel by R. Proctor. Surges in Tidal Power Basins--Can They Increase Power Output? by I. S. Robinson. Dynamic Models of Tidal Estuaries by E. R. Jeffreys. The Influence of Severn Tidal Power Schemes on Sediment Transport Processes by G. V. Miles and B. A. Worthington. Power Generation from Tidal Flows for Navigation Buoys by A. D. Grant. Turbine Caissons for the Severn Barrage by C. J. Stokes and R. D. J. Street. The Towing and Positioning of Caissons in a Tidal Barrage by R. Clare. A Preliminary Assessment of Cook Inlet Tidal Power by C. A. Debelius. Optimization of Tidal Power Schemes by S. J. Wheeler. A Preliminary Survey of Tidal Energy from Five UK Estuaries by S. J. Wishart. The Strangford Lough Tidal Energy Project by S. R. Cochrane and E. M. Wilson. Tidal Energy in France; The Rance Tidal Power Station; Some Results after 15 Years of Operation by M. Banal and A. Bichon. References (65 items).

Weatherly, G.L., Blumsack, S.L., and Bird, A.A. On the Effect of Diurnal Tidal Currents in Determining the Thickness of the Turbulent Ekman Bottom Boundary Layer. (See complete entry in Section I.)

West, J.R., and Broyd, T.W. Dispersion Coefficients in Estuaries. (See complete entry in Section III.)

Whalin, R.W., Perry, F.C., and Durham, D.L. Model Verification for Tidal Constituents. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, IV:3377-3395.

Installation and operation of an automated model data acquisition and control system have made it possible to make a quantum advance in the accuracy and time required for verification of tidal inlet (or estuary) hydraulic models. The flexible sampling rate (usually about 200 samples per model tidal cycle for each gauge) and digital recording of these data make them ideal for harmonic analysis and comparison with prototype data defining the coefficients and phase for each tidal constituent at various key locations within the tidal lagoon and at an open-ocean station removed from the immediate influence of the tidal inlet. The concept used it to force the model with the M_2 tidal constituent with the amplitude being correct at the ocean tide gauge. A harmonic analysis is performed at all other gauge locations corresponding to the prototype measurements, and the amplitude and phase (relative to the ocean tide gauge) are calculated and compared with the prototype data. Computations are made to illustrate the energy transfer with the M_2 constituent to higher order harmonics as the wave propagates from the ocean to the back of the estuary, and it is shown that this energy transfer is, at worst, the same order of magnitude in both the model and prototype. The concept ventured in this paper has been applied to verification of the Murrell Inlet, South Carolina, hydraulic model.

Wiegert, R.G. Modeling Salt Marshes and Estuaries: Progress and Problems. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 527-540.

Explanatory models of salt marshes must be based on realistic interactions between structure (niches and flow pathways) and function (species and their ecological attributes). These interactions produce behavior (changes in rates and standing stocks of energy and nutrients). Such models may be used for (1) management, (2) prediction of perturbations, or (3) development of testable hypotheses. Difficulties facing modelers involve (1) conserved flows, (2) trophic condensation,

(3) time delays, and (4) feedback controls. In addition hydrodynamic problems are important involving (5) sediment water exchanges, (6) matter/energy transport by tides, (7) catastrophic storms and tides, and (8) spatial heterogeneity. Construction and use of a carbon flow model of a coastal Georgia salt marsh are discussed. References (15 items).

Williamson, K.J., and Bella, D.A. Estuarine Sediments: Successful Model. (See complete entry in Section II.)

Wilson, R.E., and Okubo, A. Longitudinal Dispersion in a Partially Mixed Estuary. (See complete entry in Section IV.)

Winton, T.C. Long and Short Term Stability of Small Inlets. (See complete entry in Section II.)

Wood, T. A Modification of Existing Simple Segmented Tidal Prism Models of Mixing in Estuaries. ESTUARINE AND COASTAL MARINE SCIENCE, 8(4):339-347, April 1979.

The paper describes a model which combines the simple, but effective ideas underlying previous models developed by Ketchum, and Dyer & Taylor. Ketchum's data on the Raritan Estuary is used to demonstrate the application of the model. An alternative interpretation of intersegment transfers in terms of an average dispersion coefficient is shown to yield values consistent with those quoted in the literature. References (6 items).

Yoshida, S., and Kashiwamura, M. Tidal Response of Two-Layered Flow at a River Mouth. (See complete entry in Section III.)

SECTION VII. SURVEYS AND INSTRUMENTS

Methods and techniques of field surveys, observation sampling, measurements, and data collection, and various types of instruments, gages, and sampling devices.

Anderson, F.E., and Black, L.F. A Method for Sampling Fine-Grained Surface Sediments in Intertidal Areas. JOURNAL OF SEDIMENTARY PETROLOGY, 50(2):637-638, June 1980.

The upper 2-5 mm of the intertidal zone can be sampled using a dry ice acetone freezing technique. The method consists of freezing a thin layer of sediment to the bottom of a steel can to recover a thin frozen disk that can be analyzed for sediment properties such as texture and composition. References (7 items).

Anthony, R.J. Elemental Analyzer: A Key to Bay of Fundy Project. SEA TECHNOLOGY, 21(9):34-35, 55, September 1980.

The use of a Perkin-Elmer Elemental Analyzer Model 240 by the Marine Ecology Laboratory (MEL) of the Bedford Institute of Oceanography to study current environmental characteristics of the Bay of Fundy (Canada, east coast) is outlined. A method for analysis of C and N in sediment, developed by MEL, is described. The data are used for studying marine ecological processes in order to understand the dynamics of marine ecosystems and their effects on fisheries production processes. Subsequently, environmental impact reports, both natural and social, are expected on effects of reduced tides related to the proposed installation of a tidal power project in the upper bay.

Anthony, R.J. The Changing Tides on Tidal Power. ENVIRONMENTAL SCIENCE AND TECHNOLOGY. 13(5):530-532, 1979.

Article on data collecting with reference to the design of the Bay of Fundy tidal power project.

Armangau, C., and Burkhalter, R. Utilisation de la télédéction pour la résolution de problèmes d'hydrodynamique et de pollution en zones lagunaires et côtières (Teledection for Solving Hydrodynamics and Pollution Problems in Lagoon and Coastal Waters). LA HOUILLE BLANCHE, 33(7/8):549-56, 1978. (In French.)

Review of current hydrodynamics and pollution problems in coastal waters. Examples of fresh scope opened up by teledection for locating pollution and determining the process whereby effluent disperses under the effect of the dynamics of the body of water into which it discharges. What could be achieved by rational use of present operational techniques. With discussion.

Barrick, D.E. A Coastal Radar System for Tsunami Warning. REMOTE SENSING OF ENVIRONMENT, 8(4):353-358, December 1979.

A high-frequency radar system which has been used at coastal locations for measurement of surface current and wave fields is suggested and analyzed as a tsunami detection and warning system. This system would detect the presence and magnitude of a tsunami as it approaches the shore by observing the to-fro current pattern produced by the orbital velocity f the tsunami wave. For the radar system presently in existence, typical warning times exceeding 45 min are shown to be possible for Pacific United States coastal locations. References (8 items).

Barwis, J.H., Perry, F.C., and LaGarde, V.E. Computer-Aided Photo Studies of Inlet Stability. (See complete entry in Section II.)

Bennett, N.J. Initial Dilution: A Practical Study on the Hastings Long Sea Outfall. THE INSTITUTION OF CIVIL ENGINEERS PROCEEDINGS, Part 1, 70:113-122, February 1981.

Many research workers have studied the phenomenon of dilution. Most of these studies have been carried out in the laboratory under still-water conditions. The East Sussex Water and Drainage Division of the Southern Water Authority carried out a series of dye injections on the Hastings long sea outfall under moving water conditions. Rhodamine WT dye was injected within a diffuser port and the resulting dye-sewage concentrations were measured at the mouth of the port and at the sea surface. Tidal stream, salinity, temperature, and depth measurements were also taken during the study. The information obtained was correlated and the results were compared with the theories of the Water Research Centre and the Hydraulics Research Station. The study results fell mainly between the theoretical curves. References (6 items).

Bertram, C.L., and Shore, R.A. Remote Identification of a Salt Water Wedge Through Dissipative Media with a Monocycle Radar. 1 October 1979. 128p.

One purpose of this study is to show theoretically the potential of a monocycle technique to detect and identify saltwater wedges under dissipative fresh water. Also, the potential use for bathymetry is discussed, in particular for bodies of water of extremely low salinities as may be expected in some parts of the Baltic Sea, in Fjords, and in large estuaries. The importance of bathymetry for military operations in shallow water is well known. It happens to be that some bodies of water with very low salinity are in areas of particular military sensitivity. Saltwater wedges are of military importance for small submarines, swimmers, and swimmer delivery vehicles and mine and countermine warfare. References (38 items).

Bittencourt, A.C.D.P., et al. A Boat Specially Designed for Sediment Sampling in Estuaries and Bays. JOURNAL OF SEDIMENTARY PETROLOGY, 50(2):639, June 1980.

A self-propelled, platform boat of 20-cm draft permits surface sediment sampling, coring, and water sample collection in protected waters. This efficient and inexpensive boat can be transported on the roof-rack of a field vehicle. Reference (1 item).

Blain, W.R., and Webber, H.B. The Rapid Digitisation of Tide Chart Records. (See complete entry in Section VIII.)

Blanton, J.O. The Transport of Freshwater off a Multi-Inlet Coastline. (See complete entry in Section I.)

Boicourt, W.C. Circulation in the Chesapeake Bay Entrance Region: Estuary-Shelf Interaction. In: NASA. Langley Research Center Chesapeake Bay Plume Study, 61-78, October 1981.

Current meters and temperature-salinity recorders confirm the assumption that the upper layers of the continental shelf waters off Chesapeake Bay can be banded in summer, such that the coastal boundary layer (consisting of the Bay outflow) and the outer shelf flow southward while the inner shelf flows to the north, driven by the prevailing southerly winds. These measurements show that the estuary itself may also be banded in its lower reaches such that the inflow is confined primarily to the deep channel, while the upper layer outflow is split into two flow maxima on either side of this channel. References (10 items).

Bowden, K.F., and Ferguson, S.R. Variations with Height of the Turbulence in a Tidally-Induced Bottom Boundary Layer. (See complete entry in Section I.)

Brink, K.H., Allen, J.S., and Smith, R.L. A Study of Low Frequency Fluctuations near the Peru Coast. (See complete entry in Section I.)

Brown, R.D. Validation of Ocean Tide Models from Satellite Altimetry; Interim Progress Report, May-October 1978. Phoenix Corporation, McLean, Va., October 1979.

Tides in the deep ocean can be determined directly from satellite altimetry, completely independent of assumptions about earth tides, bottom topography, and coastal geometry and thus free of the uncertainties which plague numerical tide models. Existing tide models differ by 1 meter or more in the value of sea surface height in the deep ocean at a given place and time. This uncertainty is a formidable obstacle to determination of a precise marine geoids from satellite altimetry. By harmonic analysis of the temporal changes in altimeter measurements at satellite subtrack crossover points, it is possible to solve for the amplitude and phase of harmonic tidal components. However, care must be exercised in the removal of satellite orbit errors, and in the selection of crossovers for sufficient observability of the phase angle of the harmonic tidal component. Preliminary tidal solutions in the Gulf of Alaska using the relatively sparse GEOS-3 altimeter data distribution show generally good agreement (20 cm in amplitude and 25 degrees in phase) with deep ocean bottom pressure gauge measurements and establish the feasibility of this technique. SEASAT altimeter data yields a much greater density of crossovers (400 plus per 1/2 deg by 1/2 deg area), making possible much better separation of individual harmonic components within the semi-diurnal and diurnal families. References (28 items).

Burke, R., Hemond, H., and Stolzenbach, K. An Infiltrometer to Measure Seepage in Salt Marsh Soils. In: Estuarine and Wetland Processes, with Emphasis on Modeling, edited by Peter Hamilton and K. B. Macdonald, New York, Plenum Press, 1980, 413-423.

This study considers the design, construction, and operation of a device for measuring how much water seeps across the surface of salt marsh soil as it is inundated by flooding tides. The device was used in Great Sippiwisset Marsh, Cape Cod. Preliminary results confirm that infiltration during flood tide is followed by widespread exfiltration, of comparable magnitude, during ebb. Total water flux decreased with increasing distance from adjacent creeks. The infiltrometer quantifies water flux across the sediment interface under relatively undisturbed conditions and represents a definite step forward in studies of the seepage component of salt marsh water budgets. References (6 items).

Busby, M.W., and Darmer, K.I. A Look at the Hudson River Estuary. (See complete entry in Section I.)

Campbell, J.W., and Thomas, J.P., eds. Chesapeake Bay Plume Study: Superflux 1980. Proceedings of a Symposium Sponsored by the National Aeronautics and Space Administration and National Oceanic and Atmospheric Administration, Williamsburg, Virginia, January 21-23, 1981. NASA Conference Publication 2188, NOAA/NEMP III 81 ABCDEG 0042, October 1981, 522p.

A symposium was convened in Williamsburg, Virginia, January 21-23, 1981, to present the results of three interactive aircraft-boat experiments which were conducted during March, June, and October 1980 in the Chesapeake Bay. The study, called Superflux, concentrated on the use of airborne remote sensors to characterize the spatial extent, variability, and biological and chemical properties of the Chesapeake Bay plume during periods of high, moderate, and low runoff. The program, which was sponsored jointly by the Northeast Fisheries Center (NEFC) of NOAA and NASA Langley Research Center, had three objectives: (1) to understand the influence of estuarine outflow on continental shelf ecosystems, (2) to determine the role of remote sensing in future marine monitoring and assessment programs, and (3) to advance the state of the art in remote sensing systems toward the day when remote sensing can be used operationally for monitoring and assessment. References at the end of each paper.

Campbell, J.W., Esaias, W.E., and Hypes, W.D. SUPERFLUX I, II, and III Experiment Design: Remote Sensing Aspects. In: Chesapeake Bay Plume Study, National Aeronautics and Space Administration Langley Research Center, Hampton, Va., October 1981, 29-42.

The Chesapeake Bay plume study called SUPERFLUX is described. The study was initiated to incorporate the disciplines of both resources management and remote sensing in accomplishing the following objectives: (1) process oriented research to understand the impact of estuarine outflows on continental shelf ecosystems; (2) monitoring and assessment to delineate the role of remote sensing in future monitoring and assessment programs; and (3) remote sensing research: to advance the state of the art in remote sensing systems as applied to sensing of the marine environment, thereby hastening the day when remote sensing can be used operationally for monitoring and assessment and for process-oriented research. References (4 items).

Carr, A.P., Heathershaw, A.D., and Blackley, M.W.L. Swansea Bay (Sker) Project: Progress Report for the Period August 1975 to July 1976. (See complete entry in Section II.)

Chen, W.T., ed. Applications of Remote Sensing to the Chesapeake Bay; Volume 1, Executive Summary. NASA Conference Publication No. 6, April 1978.

The document presents the proceedings of a Conference held April 12-15, 1977, at the Coolfont Conference Center, Berkekey Springs, West Virginia, jointly sponsored by the National Aeronautics and Space Administration, the US Environmental Protection Agency, and the University of Maryland. The purpose of the Conference was to assemble representatives of federal and state government agencies engaged in research on the condition and evolution of the Chesapeake Bay to compose a status report, to present current activities and future plans, and to recommend a long-range future course of policies and programs. Findings of the Conference were developed and presented by the attendees divided into six working groups, each of which filed a report containing conclusions and recommendations.

Chesapeake Research Consortium, Inc. Chesapeake Bay Baseline Data Acquisition; Appendix VIII, Hydrologic Modifications. (See complete entry in Section VIII.)

Conomos, T.J. Movement of Spilled Oil in San Francisco Bay as Predicted by Estuarine Nontidal Drift. (See complete entry in Section IV.)

Cooke, J.C. Dispersal of Microfungi in the Thames River Estuary of Eastern Long Island Sound. ESTUARINE AND COASTAL MARINE SCIENCE, 11(5):537-545. November 1980.

The use of microfungi as an indicator of mass water movement in the Thames River Estuary of Eastern Long Island Sound was shown from a study over a 2-year period. The fungi, of terrestrial origin, were obtained from surface and bottom water samples taken in the river and from surface water samples in the sound. Seasonal variation in colony forming units revealed that the greatest number of fungi at any station occurred during the interval November-May and the lowest number during the interval June-September for both 1974-1975 and 1975-1976. The seasonal variation occurred in both surface and bottom water samples of stations in the river, although fewer colonies were produced from bottom samples than from surface samples. Correlations between salinity and colony forming units in the Thames River and nearshore stations and lack of correlations at the offshore stations in Long Island Sound indicate movement and dispersion of microfungi during the mixing of the water from the Thames River and Long Island Sound. Analysis of temperature, precipitation, salinity, and river discharge data indicate that fluctuations in river discharge and mixing processes are the major factors that affect the dispersion of microfungi in this estuary. References (13 items).

Crouzet, P., and Boissard, P. Rejets polluants de Saint-Malo et Dinard dans l'estuaire de la Rance (Pollution of the La Rance Estuary by Effluents from Saint-Malo and Dinard). (See complete entry in Section IV.)

Culverhouse, B. Self-Contained Digital Tide Measurement System. NOAA Technological Memorandum ERL AOML-24, January 1977. 47 p.

A digital recording, self-contained tide measurement system for Continental Shelf oceanography is described. Design parameters, construction techniques, sensor calibrations, and system tests are discussed. Pressure and temperature are measured through the use of a high precision quartz crystal and a precision epoxy-coated thermistor. Data are recorded on digital cassettes with a capacity of 11 million bits. Power consumption is extremely low with in situ recordings of 400 days possible while using an alkaline power source. Time base is supplied by a precision quartz crystal binary clock. References (4 items).

Dietrich, G., et al. General Oceanography, an Introduction. (See complete entry in Section I.)

Digital Radio Tide Gauge. HYDRO DELFT, (56):4-6, March 1980.

The Digital Radio Tide-gauge (DRT) consists of three parts: (a) Frame with pressure sensor under water; connected to (b) Buoy with electronics, batteries and VHF-transmitter, and (c) Receiving station ashore. It is a tide measuring system that is reliable, easily installed and maintained, having a digital output for further on-line processing. Also, it is a system that is small and lightweight to facilitate air transport and operation from small vessels. A simple method for deterring the water height, without the need for a fixed structure, is measuring underwater pressure. The pressure is measured by a pressure sensor which gives an output voltage proportional to the pressure. The sensor is mounted in the frame. The frame also acts as an anchor weight for the buoy and is placed on the sea bottom. The buoy is a long cylinder of small diameter, made of glass fiber, with a flotation collar acting as a fender at the same time. The receiving station is housed in a standard 19-in. module. Tidal ranges of 1, 2, 5, and 10 m can be selected. Analog and digital (BCD) outputs are available for connection to paper recorder, data-logger, or on-line use.

Downing, J.P., Jr. Particle Counter for Sediment Transport Studies. (See complete entry in Section II.)

Ecker, R.M., Sustar, J.F., and Harvey, W.T. Tracing Estuarine Sediments by Neutron Activation. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:2009-2026.

Tracing the movement of dredged sediments in north San Francisco Bay was accomplished jointly by the San Francisco District of the US Army Corps of Engineers, Explosive Excavation Research Laboratory, and the Stanford Research Institute. The study involved

developing a technique which would permit the long-term tracing of the fine sediments dredged from Mare Island Strait after disposal at the Carquinex Strait disposal site; application of the tracer; disposal of the tagged sediment for the February-March 1974 dredging of Mare Island Strait; sampling bottom sediments throughout the study area for a 10-month period; and quantitative analysis of the collected samples.

Finley, R.J., and Baumgardner, W., Jr. Interpretation of Surface-Water Circulation, Aransas Pass, Texas, Using Landsat Imagery. (See complete entry in Section I.)

Fisher, J.S., and Pickral, J.C. Transportation of Organic Detritus in Estuaries. (See complete entry in Section II.)

Frisch, A.S., and Weber, B.L. A New Technique for Measuring Tidal Currents by Using a Two-Site HF Doppler Radar System. JOURNAL OF GEOPHYSICAL RESEARCH, 85(C1):485-493, January 20, 1980.

Surface currents were measured by using a newly developed high-frequency (HF) Doppler radar technique. The system were operated in lower Cook Inlet, Alaska, in July 1977. On July 13, the radar data collected were analyzed every 30 min for 24 hr. By least squares fitting these data to two of the dominant tidal periods, 12.31 and 24.6 hr, the spatial distribution of the tidal currents for each of these two periods was determined. In addition, the spatial distribution of the mean surface currents for this 24-hr period was determined. Analysis of these data shows that near Kachemak Bay there is a distinct difference of the east-west component of tidal flow in comparison with regions farther from Kachemak. In addition, longer period components were observed for which the period could not be determined. These components exhibited gyrelike spatial patterns. Results demonstrate the use of HF radar techniques for resolving spatial and temporal currents which affect the nearshore environment. References (13 items).

Gill, S.K. and Porter, D.L. Theoretical Offshore Tide Range Derived from a Simple Defant Tidal Model Compared With Observed Offshore Tides. (See complete entry in Section VI.)

Göhren, H. Currents in Tidal Flats During Storm Surges. (See complete entry in Section I.)

Göhren, H. Port of Hamburg Flood Control. (See complete entry in Section V.)

Graf, W.H. Hydraulics of Sediment Transport. (See complete entry in Section II.)

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. (See complete entry in Section I.)

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. (See complete entry in Section I.)

Heathershaw, A.D., and Carr, A.P. Measurements of Sediment Transport Rates Using Radioactive Tracers. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 399-416.

The paper describes the results of experiments using radioactive tracers to determine sediment transport rates. These rates are then discussed in relation to observed hydraulic parameters and the thresholds of sediment movement under waves and tidal currents. Tracer measurements have been carried out at two locations in Swansea Bay, on the coast of S. Wales, UK (Lat 51°30' N, Long 3°50' W). Scandium-46 tracer has been used at both sites and its dispersion monitored over periods of up to 155 and 349 days, respectively, using conventional scintillation counter techniques and a HiFix position fixing system. Courtois and Sauzay's (1966) tracer balance method has been used to calculate depths of burial and these have been combined with the observed tracer centroid displacements to obtain sediment transport rates. Sediment transport paths have been found to be determined principally by the tidal currents and in deeper water there is evidence to suggest that the directions of net sediment drift are those given by the residual water movements. In shallower water the direction of net sediment drift has been observed to be a response to wave-induced currents (a mass transport effect being suggested) and the residual tidal flow. The thickness of the mobile sediment layer has been found to be of the order of 0.10 m and tracer has been observed to take up to 7 days to come into equilibrium with this layer. In the deeper parts of the Bay sediment transport rates of the order of 0.22 ton $day^{-1}m^{-1}$ have been obtained whereas in the shallower areas, typified by the offshore banks, sediment transport rates have been found to be of the order of 0.42 ton $day^{-1}m^{-1}$. References (14 items).

Higgs, K., et al. Tidal Hydraulics of Botany Bay (Volumes 1 and 2). (See complete entry in Section VIII.)

Hubbard, D.K., Barwis, J.H., and Nummedal, D. Sediment Transport in Four South Carolina Inlets. (See complete entry in Section II.)

Hudson, R.Y., et al. Coastal Research Models. (See complete entry in Section VI.)

Humphries, S.M. Morphologic Equilibrium of a Natural Tidal Inlet. (See complete entry in Section II.)

Jansen, R.H.J. The In Situ Measurement of Sediment Transport by Means of Ultrasound Scattering. Delft Hydraulics Laboratory, Publication No. 203, July 1978.

For the investigation of morphological changes of the coast, particularly in estuaries, in situ measurements of sediment transport are of great importance. The interpretation of data obtained with the methods used up to now (e.g. mechanical and optical methods) is rather ambiguous, especially for the transport of sand and silt in suspension. A new method has been developed based on the scattering of ultrasound (4.4 MHz) from suspended sediment

particles. Velocity, concentration, and direction of the particles are electrically determined from the Doppler signal obtained by heterodyne detection of the scattered sound. The continuous and simultaneous measurement of the momentary values of these quantities is the most important advantage of this method. References (6 items).

Keiller, D.C., and Ruxton, T.D. Waves Used for Inter-Tidal Design and Construction. (See complete entry in Section I.)

Kendall, B.M. Remote Sensing of the Chesapeake Bay Plume Salinity via Microwave Radiometry. (See complete entry in Section III.)

Kinsman, B., et al. Transport Processes in Estuaries: Recommendations for Research; Final Report. (See complete entry in Section II.)

Kjerfve, B., and Proehl, J.A. Velocity Variability in a Cross-Section of a Well-Mixed Estuary. (See complete entry in Section I.)

Lewis, R.E. Transverse Velocity and Salinity Variations in the Tees Estuary. (See complete entry in Section I.)

Mahmood, A., Ehlers, C.J., and Cilweck, B.A. Sand Waves in Lower Cook Inlet, Alaska. (See complete entry in Section VIII.)

Mann, D.P., Baird, A.A., and Parker, A.G. An Ultrasonic Method of Measuring Tide Height. National Maritime Institute, NMI Report R 37, March 1978.

Three ultrasonic tide gauges using modified echo sounders have been developed and successfully tested. Two of these have been used to monitor the tide height at Totland Bay Pier, Isle of Wight. The first system has a range of approximately 3 m, the second of 5 m. The results obtained from each, even after total submersion of the first, show extremely good correlation with Admiralty tide table predictions. After 8 months continuous use the second system needs no maintenance and shows no signs of corrosion or marine growth. The third system, with a range of approximately 5 m, includes a temperature compensation circuit and will be installed in the NMI Christchurch Bay Tower to measure the tide height during forthcoming trials. A slightly modified system has been successfully used in preliminary trials investigating the effectiveness of this system for indicating that a safe height for the release of a lowered lifeboat has been reached. References (7 items).

Mantz, P.A., and Wakeling, H.L. Aspects of Sediment Movement near to Bridgwater Bar, Bristol Channel. (See complete entry in Section II.)

Mayor-Mora, R., Mortensen, P., and Fredsoe, J. Sedimentation Studies on the Niger River Delta. (See complete entry in Section II.)

Mehta, A.J., Byrne, R.J., and DeAlteris, J.T. Measurement of Bed Friction in Tidal Inlets. (See complete entry in Section VIII.)

Moor, R. Improvement Study for the Parachique Tidal Inlet. (See complete entry in Section V.)

Muir Wood, A.M., and Fleming, C.A. Coastal Hydraulics, 2d ed. (See complete entry in Section I.)

Nash, D. Tidal Data Telemetry System Provides Continuous Depth Information. WORLD DREDGING AND MARINE CONSTRUCTION, 16(3):11-13, March 1980.

A new tide gauge and telemetry system developed in Marinav Corporation provides the dredge operator with accurate continuous depth information. Using pressure transducers located on the sea bottom, the Marinav tide gauge and telemetry system produces depth readouts every 5 min at the receiver/display unit on the dredge. Remote transmitter/processor units are housed in the shore station or tethered buoy. The system provides an efficient and flexible means for dredging in tidal waters and can be tailored by the user for a specific need and for changing applications.

Nasner, H. Transport Mechanism in Tidal Dunes. (See complete entry in Section II.)

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients. (See complete entry in Section IV.)

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. (See complete entry in Section I.)

Pequegnat, W.W., Fay, R.R., and Wastler, T.A. Combined Field-Laboratory Method for Chronic Impact Detection in Marine Organisms and Its Application to Dredged Material Disposal. (See complete entry in Section V.)

Proceedings of the Eighth Dredging Seminar, November 8, 1975. (See complete entry in Section V.)

Quadfasel, D., and Schott, F. Comparison of Different Methods of Current Measurements. DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 32(1):27-38, 1979.

Comparisons of different Lagrangian and Eulerian near surface current measurements in shallow water during the experiment Baltic '75 show a strong influence of winds and surface waves on the measured data. The AMF vector averaging current meter (VACM) recordings and the drifts of dye patches show a reasonable agreement in speed and direction in all observed weather conditions. The Aanderaa current meter reproduces the directions well but increasingly overestimates the speed with increasing wave height. Drifting floats proved to be only usable in calm weather. In the halocline a value of 2.0 has been observed for the ratios of the energies in the low frequency range obtained from VACM instruments on surface and subsurface moorings. These ratios are constant only during stable weather conditions and scatter largely during periods of quick changes in the windfield. Coherences between the north and east current components at surface moored instruments are significantly overestimated. References (12 items).

Rattray, M., Jr., and Dworski, J.G. Comparison of Methods for Analysis of the Transverse and Vertical Circulation Contributions to the Longitudinal Advective Salt Flux in Estuaries. (See complete entry in Section III.)

Rohde, H. Sand Movement Investigations by Means of Radioactive Tracers in a Hydraulic Model and in the Field. (See complete entry in Section II.)

Sarabun, C.C., Jr. Mapping Watermass Boundaries Using Fluorosensing Lidar. In: NASA. Langley Research Center Chesapeake Bay Plume Study, 141-158, October 1981.

An initial application of multispectral LIDAR data from the NASA airborne oceanographic lidar (AOL) to the mapping of watermass boundaries is presented. The approach uses the multispectral lidar data from the fluorosensing mode in a cluster analysis to define water types. Individual data points are classified as to parent water types and then plotted in plan view to show the water-mass boundaries and mixing regions. The methodology was applied to the AOL data from the SUPERFLUX overflights. The results are compared to salinity-mapping radar results in the same region. References (11 items).

Schroeder, W.W. Dispersion and Impact of Mobile River System Waters in Mobile Bay, Alabama. (See complete entry in Section VIII.)

Sea Grant Publications Index 1979. (See complete entry in Section I.)

Severn Tidal Power. (See complete entry in Section V.)

Shemdin, O.H., Jain, A., and Hsiao, S.V. Inlet Current Measured with Seasat-1 Synthetic Aperture Radar. SHORE AND BEACH, 48(4):35-37, October 1980.

Seasat-1 was an experimental satellite developed and launched by NASA-Jet Propulsion Laboratory to determine the possibility of studying the sea from space. On-board sources direct microwave beams at the ocean surface; the reflected data are received on the satellite and telemetered to earth stations for processing. One of the instrument systems was an imaging radar which yielded an image of the surface wave pattern and a measure of surface-water velocities. The reliability of these remotely sensed measurements was tested by concurrent "surface truth" measurements made at the ocean surface. This article describes the results obtained in one of these experiments, namely, a comparison of the currents at a jettied tidal entrance, as shown by the Seasat-1 image, with the currents predicted in the NOS Current Table. References (4 items).

Shemdin, O.H., et al. Comprehensive Monitoring of a Beach Restoration Project. (See complete entry in Section V.)

Stevenson, L.H., Chrzanowski, T.H., and Kjerfve, B. Short-term Fluxes Through Major Outlets of the North Inlet Marsh in Terms of Adenosine 5'-Triphosphate[a]. (See complete entry in Section III.)

Swift, M., Reichard, R., and Celikkol, B. Stress and Tidal Current in a Well-Mixed Estuary. (See complete entry in Section I.)

Thomas, J.P. SUPERFLUX I, II, and III Experiment Designs: Water Sampling and Analysis. (See complete entry in Section VIII.)

West, J.R. and Cotton, A.P. The Measurement of Diffusion Coefficients in the Conwy Estuary. ESTUARINE, COASTAL AND SHELF SCIENCE, 12(3): 323-336, March 1981.

A continuous point source dye injection technique has been used to study transverse and vertical diffusion in a saline tidal reach of the Conwy estuary. Data were collected during periods of the flood and ebb tide when the water velocity was fairly steady. The tracing technique was found to be adequate, though suggestions for further improvements have been made. The transverse diffusion coefficients were found to be dependent on flow direction and tidal range for the conditions studied. The data agreed fairly well with other open channel flow data for large width to depth ratios. The vertical diffusion coefficients were smaller for ebb tides than for flood tides, and in all cases were smaller than for homogeneous conditions. References (14 items).

Whitlock, C.H., et al. Laboratory and Field Measurements of Upwelled Radiance and Reflectance Spectra of Suspended James River Sediments near Hopewell, Virginia. National Aeronautics and Space Administration, NASA Technical Paper No. 1292, October 1978.

Spectral reflectance characteristics of suspended Bermuda Hundred and Bailey Bay bottom sediments taken from the Hopewell, Va., area were measured in the laboratory for water mixture total suspended solids concentrations between 4 and 173 parts per million. Field spectral reflectance measurements were made of the James River waters near Bermuda Hundred on two occasions. The results of these tests indicate that both Bermuda Hundred and Bailey Bay suspended sediments produce their strongest reflectance in the green and red regions of the spectrum. References (6 items).

Whittle, P.J., and Horne, M.W. Characterization of Oil Spills on Inland and Estuarine Waters. (See complete entry in Section IV.)

Williamson, K.J., and Bella, D.A. Estuarine Sediments: Successful Model. (See complete entry in Section II.)

Young, R.M., and Ackers, P. Field Tests of Rip-Rap Slope Protection in a Shallow Coastal Area. (See complete entry in Section VIII.)

SECTION VIII. BASIC PHYSICAL DATA

Tide tables, datum planes, tidal current charts, and the results, tabulation, and discussion of basic physical data obtained from field surveys, investigations, and data collection programs. Physical features of ports, harbors, estuaries, etc., when related to tidal hydraulic problems.

Akroya, J., and Kilner, A. Ohiwa Harbour--Natural Values. SOIL AND WATER, 16(2):18-21, April 1980.

Ohiwa Harbor is a shallow tidal estuary (about 26 km^2 in area), lying in the eastern Bay o Plenty, 7 km east of Whakatane. The area is being studied as part of the Fisheries Management Division's estuarine program. Ohiwa was chosen for its relatively natural state; its small size compared to more northern harbor; and the local availability of MAF laboratory facilities and staff. From this study it is hoped that a management plan, which will allow best use of the fishery resource, can be constructed for the harbor. A sparsely populated catchment, and the absence of either significant pollution or large reclamations and dredging, have contributed to Ohiwa remaining near to its natural state. This allows comparison with other more modified estuaries to assess the effects of development upon the biota.

Anwar, H.O. A Study of the Turbulent Structure in a Tidal Flow. (See complete entry in Section I.)

Anwar, H.O., and Atkins, R. Turbulence Measurements in Simulated Tidal Flow. (See complete entry in Section I.)

April, G.C., and Raney, D.C. Predicting the Effects of Storm Surges and Abnormal River Flow on Flooding and Water Movement in Mobile Bay, Alabama. (See complete entry in Section III.)

April, G.C., Ng, S., and Brett, C.E. Sediment Transportation and Deposition Models for Mobile Bay, Alabama. (See complete entry in Section II.)

Bayliss-Smith, T.P., et al. Tidal Flows in Salt Marsh Creeks. (See complete entry in Section I.)

Behrens, E.W., and Watson, R.L. Corpus Christi Exchange Pass 1972-1976. Coastal Sediments '77, 5th Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE, Charleston, South Carolina, November 2-4, 1977, 790-796.

The Corpus Christi Water Exchange Pass extending from Corpus Christi Bay to the Gulf of Mexico through Mustang Island, Texas, was opened in August 1972. Its channel was approximately 3 km long by 30 m wide by 2.4 m deep. The ocean end was jettied for a length of about 400 m and was dredged 50 m wide and 3.5 m deep. The jetties extended across approximately 2/3 the width of the bar-trough system which is quite dynamic but usually has three well developed offshore bars. A 23-deg bend was located about 1 km from the ocean end of the channel, and a highway bridge constricts the channel just seaward of the bend. A more complete description is given by Behrens et al. (1977). Tides are mixed, diurnal, and semidiurnal and vary from 0.2 to 0.9 m in range. Breakers average 0.8 m in height and 6 to 7 sec in period. Alongshore transport rates average 555 × 10^3 m^3 gross and 48 × 10^3 m^3 net (southwestward) yearly. The strongly bimodal character derives from a bimodal wave generating wind system with onshore south-southeasterly trade winds predominating from March to September and strong northeasterly to northwesterly winds (northers) associated with cold fronts occurring from September through March. This inlet was monitored to some degree for 4 years from preopening to August 1976. Monitoring observations included LEO wave observations (Bruno and Hiipakka, 1973), tide level recording, current velocity measurements, and surveys of beach profiles, offshore bathymetry and 18 to 22 channel cross sections. Most of the data from these observations are presented in Watson and Behrens (1976) and Behrens et al. (1977). References (6 items).

Behrens, E.W., Watson, R.L., and Mason, C. Hydraulics and Dynamics of New Corpus Christi Pass, Texas: A Case History 1972-1973. (See complete entry in Section II.)

Bell, P.R., et al. Measurement and Analysis of the Effects of Stormwater on the Lane Cove Estuary. (See complete entry in Section IV.)

Bennett, N.J. Initial Dilution: A Practical Study on the Hastings Long Sea Outfall. (See complete entry in Section VII.)

Blackford, B.L. On the Generation of Internal Waves by Tidal Flow over a Sill: A Possible Nonlinear Mechanism. (See complete entry in Section I.)

Blain, W.R., and Webber, H.B. The Rapid Digitisation of Tide Chart Records. INTERNATIONAL HYDROGRAPHIC REVIEW, 55(2):85-91, July 1978.

The majority of tide recordings have been and still are, for historical, economical, or visual reasons, on roll or strip chart paper. Therefore, in the analysis of tide recordings, there is often the need for digitization of the data. Digitization can be accomplished manually, but the process is laborious and slow even with the aid of electro-static X-Y plotters, and especially so if shorter than hourly time increments are required. The paper describes the technique and equipment employed to achieve a rapid and effective digitization of the recordings, and is thought to be novel with regard to this particular application.

Blair, C.M. Mass Transfer Verifications of Tidal Froude Models. (See complete entry in Section VI.)

Blanton, J.O. The Transport of Freshwater off a Multi-Inlet Coastline. (See complete entry in Section I.)

Boicourt, W.C. Circulation in the Chesapeake Bay Entrance Region: Estuary-Shelf Interaction. (See complete entry in Section VII.)

Bowden, K.F., and Ferguson, S.R. Variations with Height of the Turbulence in a Tidally-Induced Bottom Boundary Layer. (See complete entry in Section I.)

Brink, K.H., Allen, J.S., and Smith, R.L. A Study of Low Frequency Fluctuations near the Peru Coast. (See complete entry in Section I.)

Brockmann, C., et al. The Tidal Stream in the German Bight. (See complete entry in Section VI.)

Brown, R.D. Validation of Ocean Tide Models from Satellite Altimetry; Interim Progress Report, May-October 1978. (See complete entry in Section VII.)

Burwash, W.J., and Matich, M.A.J. Stage Loading of a Highway Embankment on Tidal Flats. (See complete entry in Section V.)

Busby, M.W., and Darmer, K.I. A Look at the Hudson River Estuary. (See complete entry in Section I.)

Callaway, R.J. Flushing Study of South Beach Marina, Oregon. (See complete entry in Section VI.)

Campbell, J.W., and Thomas, J.P., eds. Chesapeake Bay Plume Study: Superflux 1980. (See complete entry in Section VII.)

Carr, A.P., Heathershaw, A.D., and Blackley, M.W.L. Swansea Bay (Sker) Project: Progress Report for the Period August 1975 to July 1976. (See complete entry in Section II.)

Cartwright, D.E., et al. On the St. Kilda Shelf Tidal Regime. DEEP-SEA RESEARCH, 27A (1980)1, 61-70, January 1980.

New records of tidal elevation from St. Kilda and the west coast of North Uist make it possible to estimate pressure gradients across the shelf, to supplement existing records parallel to the shelf edge. Results confirm the existence of relatively large diurnal currents, which are clearly barotropic. Diurnal elevations are markedly smaller at the coast, and this is explained by the superposition of a Kelvin wave and a shelf wave of similar amplitude but in antiphase. The currents corresponding to this model agree fairly well with those measured directly by Cartwright (1969), and confirm less exact calculations made by Huthnance (1973). References (12 items).

Chesapeake Research Consortium, Inc. Chesapeake Bay Baseline Data Acquisition; Appendix VIII, Hydrologic Modifications. EPA/903/9-78/026, September 1978.

The report identifies researchers conducting current research programs relating to hydrologic modifications in the Chesapeake Bay estuarine system. The data files included in this report are compiled from the Environmental Data Base Directory and reflect data applicable to hydrologic modifications from 1973 to the present. The report also identifies the major past, present, or planned monitoring efforts. The data will aid in the design of future research and monitoring efforts for the Chesapeake Bay.

Clark, L.J., Ambrose, R.B., Jr., and Crain, R.C. A Water Quality Modelling Study of the Delaware Estuary. (See complete entry in Section VI.)

Collins, M., Ferentinos, G., and Banner, F.T. The Hydrodynamics and Sedimentology of a High (Tidal and Wave) Energy Embayment (Swansea Bay, Northern Bristol Channel). (See complete entry in Section I.)

Conomos, T.J. Movement of Spilled Oil in San Francisco Bay as Predicted by Estuarine Nontidal Drift. (See complete entry in Section IV.)

Crawford, W.R. Analysis of Fortnightly and Monthly Tides. (See complete entry in Section I.)

Daddio, E., Wiseman, W.J., and Murray, S.P. Inertial Currents over the Inner Shelf near 30°N. (See complete entry in Section I.)

Daly, M.A., and Mathieson, A.C. Nutrient Fluxes Within a Small North Temperate Salt Marsh. (See complete entry in Section IV.)

Davies, A.M., and Flather, R.A. Computation of the Storm Surge of 1 to 6 April 1973 Using Numerical Models of the North West European Continental Shelf and the North Sea. (See complete entry in Section VI.)

Davies, A.M., and Furnes, G.K. Observed and Computed M_2 Tidal Currents in the North Sea. (See complete entry in Section VI.)

Davies, J.L. Geographical Variation in Coastal Development. (See complete entry in Section II.)

DeAlteris, J., McKinney, T., and Roney, J. Beach Haven and Little Egg Inlets, A Case Study. (See complete entry in Section II.)

DeAlteris, J., et al. The Dynamics of the Coastal Boundary Waters Offshore Southern New Jersey. (See complete entry in Section I.)

De Grandpre, C.D.B., El-Sabh, M.I., and Salamon, J.C. A Two-Dimensional Numerical Model of the Vertical Circulation of Tides in the St. Lawrence Estuary. (See complete entry in Section VI.)

Dierckx, P., et al. A New Method of Cubature Using Spline Functions. (See complete entry in Section I.)

Dietrich, G., et al. General Oceanography, an Introduction. (See complete entry in Section I.)

Doyle, B.E., and Wilson, R.E. Lateral Dynamic Balance in the Sandy Hook to Rockaway Point Transect. (See complete entry in Section I.)

Ecker, R.M., Sustar, J.F., and Harvey, W.T. Tracing Estuarine Sediments by Neutron Activation. (See complete entry in Section VII.)

Ekblom, R. The Ten Per Cent Method of Predicting Tide Levels Between High and Low Water. (See complete entry in Section I.)

Garrett, C., and Toulany, B. A Variable-Depth Green's Function for Shelf Edge Tides. (See complete entry in Section VI.)

Göhren, H. Port of Hamburg Flood Control. (See complete entry in Section V.)

Gopalakrishnan, T.C. and Machemehl, J.L. Numerical Flow Model for an Atlantic Coast Barrier Island Tidal Inlet. (See complete entry in Section VI.)

Gordon, R.B., and Spaulding, M.L. A Nested Numerical Tidal Model of the Southern New England Bight. (See complete entry in Section VI.)

Graf, W.H. Hydraulics of Sediment Transport. (See complete entry in Section II.)

Gurewitz, P.H. Hydraulic Research in the United States and Canada, 1978. (See complete entry in Section I.)

Hamilton, P., and Macdonald, K.B., eds. Estuarine and Wetland Processes, with Emphasis on Modeling. (See complete entry in Section I.)

Higgs, K., et al. Tidal Hydraulics of Botany Bay (Volumes 1 and 2). University of New South Wales Water Research Laboratory, Report No. 155, March 1980.

Tidal currents within Botany Bay and its tributary rivers have been examined with the objective of formulating an overall assessment of tidal action within the bay and rivers and the further objective of examining the effect on water movement patterns of reclamation and dredging works within the bay. Data have been derived from field measurements, a physical hydraulic model, and a mathematical model. In spite of some limitations and discrepancies in the data, general agreement has been observed amongst the data from the three sources in respect of conditions existing up to the time of the study. The physical model and the mathematical model have been used to examine the probable effects of further works within the bay. The occurrence of a net tidal circulation within the bay has been investigated. The implications of the results in relation to water quality, sediment movement, and related studies have been briefly examined. Volume 1 contains descriptions of the methods used in carrying out the study, together with summaries of the data and discussions of the results. Volume 2 contains the detailed data derived from the study. References (12 items).

Isozaki, I. and Kitahara, E. Tides in the Bays of Ariake and Yatsushiro. (See complete entry in Section I.)

Jensen, P., Rola, A., and Tyrawski, J. Tidal Wetlands and Estuarine Coliform Bacteria. (See complete entry in Section IV.)

Jones, C.P., and Mehta, A.J. A Comparative Review of Sand Transfer Systems at Florida's Tidal Entrances. (See complete entry in Section V.)

Kelley, J.T. Size Distribution of Disaggregated Inorganic Suspended Sediment: Southern New Jersey Inner Continental Shelf. (See complete entry in Section II.)

Kendall, B.M. Remote Sensing of the Chesapeake Bay Plume Salinity via Microwave Radiometry. (See complete entry in Section III.)

Kjerfve, B., and Proehl, J.A. Velocity Variability in a Cross-Section of a Well-Mixed Estuary. (See complete entry in Section I.)

Krause, G. Grundlagen zur Trendermittlung des Salzgehalts in Tide-Aestuarien (Fundamentals of Trend Analysis of Salinity in a Tidal Estuary). (See complete entry in Section III.)

Krause, G. Physical Processes in Tidal Estuaries in Relation to the Monitoring of Water Quality. (See complete entry in Section III.)

Leatherman, S.P., ed. Barrier Islands: From the Gulf of St. Lawrence to the Gulf of Mexico. (See complete entry in Section I.)

Loder, J.W. Topographic Rectification of Tidal Currents on the Sides of Georges Bank. (See complete entry in Section I.)

Luynenburg, R.W.E., and van Gent, W.G. Extrapolation of Shore-Based Tide Gauge Data for Offshore Reduction. (See complete entry in Section I.)

Mahmood, A., Ehlers, C.J., and Cilweck, B.A. Sand Waves in Lower Cook Inlet, Alaska. Journal of the Geotechnical Engineering Division, Proceedings, ASCE, 107(GT10):1293-1307, October 1981.

Acoustic (geophysical) methods were applied to investigate the sea-floor geological conditions, particularly sand waves, which might place constraints on construction in an area of potential offshore development in lower Cook Inlet, Alaska. Multisystem, high resolution, marine acoustic survey data were collected using a sparker, tuned transducer, acoustipulse, fathometer, and side-scan sonar. Based on 65 sea-floor samples obtained in the northern portion of the study area, the seafloor soils consisted of over 90 percent sand by volume. This portion of lower Cook Inlet contained the most numerous sand waves and contained sand waves of 5 ft (1.5 m) or greater height over an 80 percent length of the survey lines. The possibility of sand wave movement is examined by reviewing the two phase (water-sand) flow regime and by repeat geophysical profiling. The present flow regime appears to be conducive to the formation of ripples and dunes, but tidal flow durations may be insufficient for the formation of large bed forms. References (17 items).

Mantz, P.A., and Wakeling, H.L. Aspects of Sediment Movement near to Bridgwater Bar, Bristol Channel. (See complete entry in Section II.)

Mehta, A.J., Byrne, R.J., and DeAlteris, J.T. Measurement of Bed Friction in Tidal Inlets. In: Proceedings, Fifteenth Coastal Engineering Conference, ASCE, 11-17 July 1976, Honolulu, Hawaii, II:1701-1720.

The flow characteristics and the stability of a tidal inlet are governed, other factors, by the channel bed friction. In order to determine the bed shear stress regime and the frictional characteristics, near-bed velocity profiles were obtained at the throat sections of two inlets, John's Pass and Blind Pass, on the Gulf Coast of Florida. A specially designed steel cage with five current meters in a vertical array was used to obtain the profiles in the bottom one meter of the flow. The profiles were found to be logarithmic but it is noted that, especially near the times of slack water, the effect of inertia becomes significant. However, during the major part of the flood or ebb flow period, frictional effects are dominant. References (13 items).

Merry, C.L. Processing of Tidal Records at Hout Bay Harbour. INTERNATIONAL HYDROGRAPHIC REVIEW, 57(1):149-154, January 1980.

Twenty-two years of tidal records at Hout Bay Harbor in South Africa have been digitized and analyzed in order to seek long-term variations in mean sea level. After accounting for a local movement of the tide gauge, a rise in sea level of approximately 1 mm per year has been detected. This agrees well with global estimates of the eustatic rise in sea level. References (5 items).

Mittelstaedt, E., et al. Tidal Currents off Mauritania at 21°40' N. (See complete entry in Section I.)

Muir Wood, A.M., and Fleming, C.A. Coastal Hydraulics, 2d ed. (See complete entry in Section I.)

Munday, J.C., Jr., and Fedosh, M.S. Chesapeake Bay Plume Dynamics from LANDSAT. In: NASA, 79-92, October 1981. Langley Research Center Chesapeake Bay Plume Study.

LANDSAT images with enhancement and density slicing show that the Chesapeake Bay plume usually frequents the Virginia coast south of the Bay mouth. Southwestern (compared to northern) winds spread the plume easterly over a large area. Ebb tide images (compared to flood tide images) show a more dispersed plume. Flooding waters produce high turbidity levels over the shallow northern portion of the Bay mouth. References (6 items).

Mungall, J.C.H., and Matthews, J.B. The M_2 Tide of the Irish Sea: Hourly Configurations of the Sea Surface and of the Depth-Mean Currents. (See complete entry in Section I.)

Neilson, B.I., and Cronin, L.E., eds. Estuaries and Nutrients. (See complete entry in Section IV.)

New York State, Department of Environmental Conservation, Hudson River Basin Study Group. (See complete entry in Section I.)

Nystrom, J.B., Hecker, G.E., and Moy, H.C. Heated Discharge in an Estuary: Case Study. (See complete entry in Section VI.)

Ozturk, Y.F. Mathematical Modeling of Dissolved Oxygen in Mixed Estuaries. (See complete entry in Section VI.)

Permanent International Association of Navigation Congresses. Improvement and Maintenance of Navigation Channels and Control of the Regime in Estuaries in Relation to the Energy Due to Tidal Movement, Waves and Swell at the Entrance. (See complete entry in Section V.)

Pinet, P.R., and Morgan, W.P., Jr. Implications of Clay-Provenance Studies in Two Georgia Estuaries. (See complete entry in Section II.)

Posmentier, E.S., and Raymont, J.M. Variations of Longitudinal Diffusivity in the Hudson Estuary. (See complete entry in Section I.)

Pratte, B.D. Churchill River Salt Water Tidal Model. (See complete entry in Section VI.)

Qasim, S.Z., and Gupta, R.S. Environmental Characteristics of the Mandovi-Zuari Estuarine System in Goa. (See complete entry in Section III.)

Redfield, A.C. The Tides of the Waters of New England and New York. (See complete entry in Section I.)

Riepma, H.W. Observed Short-Time Temperature Variations and Tidal Current Constants in the North Sea South East of the Dogger Bank: (Comparison of two Seasons). DEUTSCHE HYDROGRAPHISCHE ZEITSCHRIFT, 33(2):82-89, 1980.

Observations are reported of variations in the thermal structure and of tidal current constants at various depths in the Bloeden area SE of the Dogger Bank. Measurements on the same position during two seasons are compared. The first experiment took place during August 1975 in stratified waters, while the second took place during JONSDAP '76, in which stratification developed. References (6 items).

Roberts, P.J.W. Current Measurements and Mathematical Modeling in Southern Puget Sound. (See complete entry in Section VI.)

Roelfzema, A. Effect of Harbours on Salt Intrusion in Estuaries. (See complete entry in Section III.)

Rohde, H. Sand Movement Investigations by Means of Radioactive Tracers in a Hydraulic Model and in the Field. (See complete entry in Section II.)

Ruzecki, E.P. Temporal and Spatial Variations of the Chesapeake Bay Plume. In: NASA Langley Research Center Chesapeake Bay Plume Study, Virginia Institute of Marine Science, Gloucester Point, October 1981, 111-130.

Historical records and data obtained during the SUPERFLUX experiments are used to describe the temporal and spatial variations of the

effluent waters of Chesapeake Bay. The alongshore extent of the plume resulting from variations of freshwater discharge into the Bay and the effects of wind are illustrated. Variations of the cross-sectional configuration of the plume over portions of a tidal cycle and results of a rapid underway water sampling system are discussed. References (11 items).

Rydelek, P.A., and Knopoff, L. Long-Period Lunar Tides at the South Pole. (See complete entry in Section I.)

Rydelek, P.A., Knopoff, L., and Zürn, W. Observation of 18.6-Year Modulation Tide at the South Pole. (See complete entry in Section I.)

Schroeder, W.W. Dispersion and Impact of Mobile River System Waters in Mobile Bay, Alabama. Auburn University, Water Resources Research Institute, WRRI-Bulletin 37, August 1979.

Twenty-two field surveys, carried out between November, 1976, and September, 1978, are used to characterize the dispersion and impact of Mobile River System waters in Mobile Bay, Alabama. River discharge rates ranged from 7-day average low flows of <400 cu m/sec to a 5-year frequency flood of approximately 9,200 cu m/sec. These discharges serve as a simple source of fresh water at one extreme to a role at the other extreme, rendering the majority of the bay a near limnetic system. Salinity patterns that are longitudinally, laterally, and vertically variable result from the mixing of river waters with bay waters. The configuration of the bay, local winds, and astronomical tides are shown to play key modifying roles. References (13 items).

Schubel, J.R., and Carter, H.H. Suspended Sediment Budget for Chesapeake Bay. (See complete entry in Section II.)

Schwiderski, E.W. Global Ocean Tides, Part I: A Detailed Hydrodynamical Interpolation Model. (See complete entry in Section VI.)

Sea Grant Publications Index 1979. (See complete entry in Section I.)

Severn Tidal Power. (See complete entry in Section V.)

Shemdin, O.H., Jain, A., and Hsiao, S.V. Inlet Current Measured with Seasat-1 Synthetic Aperture Radar. (See complete entry in Section VII.)

Shemdin, O.H., et al. Comprehensive Monitoring of a Beach Restoration Project. (See complete entry in Section V.)

Smith, R.A. Golden Gate Tidal Measurements: 1854-1978. Journal of the Waterways Division, Proceedings, ASCE, 106(WW3):407-410, August 1980.

The recent discovery of leveling connections between the benchmarks of the tide stations at Fort Point, Sausalito, and The Presidio, San Francisco, California, between 1954 and the present, provide a continuous set of tidal measurements in the Golden Gate area. This is the only location in the United States with over 100 years of continuous tidal measurements. Such a long series of tidal measurements are important in global sea level analysis, variability of water level relative to land over long periods, and historical tidal boundary determination.

Sorensen, R.M., and Seelig, W.N. Hydraulics of Great Lakes Inlet-Harbors Systems. (See complete entry in Section I.)

Storm Tide Warning Service Extends Forecast. (See complete entry in Section I.)

Stout, H.P. Prediction of Oxygen Deficits Associated with Effluent Inputs to the Rivers of the Forth Catchment. (See complete entry in Section IV.)

Svendsen, H., and Thompson, R. Wind-Driven Circulation in a Fjord. (See complete entry in Section I.)

Swanson, R.L., and Thurlow, C.I. A Uniform Tidal Datum System for the United States of America. INTERNATIONAL HYDROGRAPHIC REVIEW, 56(1):143-151, January 1979.

The tidal datum of Mean Lower Low Water will be adopted as Chart Datum for all nautical charts, bathymetric maps, and tide tables of the National Ocean Survey. The Mean Higher High Waterline will be depicted as the Shoreline on all nautical charts and bathymetric maps. The low waterline, when called for on large-scale charts with broad beach slopes, will be the Mean Lower Low Waterline. Legal difficulties may require the retention (as it did for creation) of Gulf Coast Water Datum and the establishment of Gulf Coast High Water Datum. However, these datums lie at the elevations of Mean Lower Low Water and Mean Higher High Water, respectively, in a regime of alternating mixed and diurnal tides. Implementation will probably require 6 years. Accuracies will be consistent with present practices. References (5 items).

Tee, Kim-Tai. The Structure of Three-Dimensional Tide-Generating Currents: Experimental Verification of a Theoretical Model. (See complete entry in Section I.)

Tee, Kim-Tai. Tide-Induced Residual Current--Verification of a Numerical Model. (See complete entry in Section VI.)

Thomas, J.P. SUPERFLUX I, II, and III Experiment Designs: Water Sampling and Analysis. In: NASA. Langley Research Center Chesapeake Bay Plume Study, 43-60, October 1981.

Both airborne remote sensors and seagoing research vessels were used to study the effects of man's continual use of the Chesapeake Bay offshore environments. The major focus of the study was to: (1) advance the development and transfer of improved remote sensing systems and techniques for monitoring environmental quality and effects on living marine resources; (2) increases understanding of the influence of estuarine outwellings (plumes) on contiguous shelf ecosystems; and (3) provide a synoptic, integrated, and timely data base for

application to problems of marine resources and environmental quality.

Ueshima, H., Fujiwara, T., and Hayakawa, N. Salt Transport Mechanism in Tidal Waters. (See complete entry in Section III.)

Vincent, C.E. The Interaction of Wind-Generated Sea Waves with Tidal Currents. (See complete entry in Section I.)

Vincent, C.L., and Corson, W.D. The Geometry of Selected U. S. Tidal Inlets. US Army Corps of Engineers, General Investigation of Tidal Inlets, GITI Report 20, May 1980.

The geometry of the throat and ebb delta of 67 US tidal inlets is investigated. Thirteen parameters indicative of the tidal inlet geometry are defined and measured with correlations developed. The correlation study indicated a number of strong statistical relationships with minimum inlet width cross-sectional area being particularly important. Cluster analysis and discriminant analysis are applied to the data and an objective classification of the inlets into six groups achieved. Literature Cited (25 items).

Vukovich, F.M., and Crissman, B.W. Monitoring the Chesapeake Bay Using Satellite Data for SUPERFLUX III. In: NASA. Langley Research Center Chesapeake Bay Plume Study, 93-110, October 1981.

The TIROS-N and NOAA-6 and GOES visible infrared satellite data were used to identify and locate surface oceanographic thermal fronts for the purpose of issuing daily and premission advisory briefings in support of the SUPERFLUX III in situ and remote sensing experiment in the Chesapeake Bay region. Satellite data were collected for the period 1-22 October 1980. A summary of that data is presented.

Walton, T.L., Jr., and Adams, W.D. Capacity of Inlet Outer Bars to Store Sand. (See complete entry in Section II.)

Wells, J.T., and Coleman, J.M. Physical Processes and Fine-Grained Sediment Dynamics, Coast of Surinam, South America. (See complete entry in Section II.)

West, J.R. and Cotton, A.P. The Measurement of Diffusion Coefficients in the Conwy Estuary. (See complete entry in Section VII.)

Wilding, A., Collins, M., and Ferentinos, G. Analyses of Sea Level Fluctuations in Thermaicos Gulf and Salonica Bay, Northwestern Agean Sea. (See complete entry in Section I.)

Wilson, R.E., and Okubo, A., Longitudinal Dispersion in a Partially Mixed Estuary. (See complete entry in Section IV.)

Winton, T.C. Long and Short Term Stability of Small Inlets. (See complete entry in Section II.)

Wolf, J. Estimation of Shearing Stresses in a Tidal Current with Application to the Irish Sea. (See complete entry in Section I.)

Wright, L.D., Thom, B.G., and Higgins, R.J. Wave Influences on River-Mouth Depositional Process: Examples from Australia and Papua New Guinea. (See complete entry in Section II.)

Yakuwa, I., Takahashi, S., and Ohtani, M. Salt Water Intrusion into the Mouth of the Teshio River. (See complete entry in Section III.)

Yanagi, T. Vertical Residual Flow in Kasado Bay. (See complete entry in Section I.)

Yoshida, S., and Kashiwamura, M. Tidal Response of Two-Layered Flow at a River Mouth. (See complete entry in Section III.)

Young, R.M., and Ackers, P. Field Tests of Rip-Rap Slope Protection in a Shallow Coastal Area. In: Proceedings of Seventeenth Congress of the International Association for Hydraulic Research, August 15-19, 1977, Baden-Baden, Federal Republic of Germany, 4(Subj.C):65-72.

The design of quarried stone riprap slope protection is usually based on model test results. Early research is with uniform waves rather than the irregular waves of a real sea and there has also been uncertainty about the influence of scale effects in converting laboratory results into practical design methods. The field trials described in this paper are being carried out under contract to CIRIA (The Construction Industry Research and Information Association). The site is in the Wash Esturay where an embankment has been built to test aspects of the construction of impoundments in tidal areas for water storage, for CWPU (Central Water Planning Unit). The work has been guided by advice from HRS (Hydraulics Research Station), Wallingford. Five sizes of riprap are being tested in an experimental section of slope protection. The data collected include wind strengths and direction, tide levels, and wave climate. Damage is assessed by surveys at regular intervals based on measuring down to the riprap from a tagged taut wire. Computer analysis converts the survey data to volumetric change for comparison with previous laboratory research. References (5 items).

Zetler, B., Cartwright, D., and Berkman, S. Some Comparisons of Response and Harmonic Tide Predictions. (See complete entry in Section I.)

REPORTS OF COMMITTEE ON TIDAL HYDRAULICS

Report No.	Title	Date
1	Evaluation of Present State of Knowledge of Factors Affecting Tidal Hydraulics and Related Phenomena	Feb 1950
2	Bibliography on Tidal Hydraulics	Feb 1954
	Supplement No. 1, Material Compiled Through May 1955	Jun 1955
	Supplement No. 2, Material Compiled from May 1955 to May 1957	May 1957
	Supplement No. 3, Material Compiled from May 1957 to May 1959	May 1959
	Supplement No. 4, Material Compiled from May 1959 to May 1965	May 1965
	Supplement No. 5, Material Compiled from May 1965 to May 1968	Aug 1968
	Supplement No. 6, Material Compiled from May 1968 to May 1971	Jul 1971
	Supplement No. 7, Material Compiled from May 1971 to May 1974	Jun 1975
	Supplement No. 8, Material Compiled from June 1974 to June 1980	Dec 1980
3	Evaluation of Present State of Knowledge of Factors Affecting Tidal Hydraulics and Related Phenomena (revised edition of Report No. 1)	May 1965

Technical Bulletin No.	Title	Date
1	Sediment Discharge Measurements in Tidal Waterways	May 1954
2	Fresh Water-Salt Water Density Currents, a Major Cause of Siltation in Estuaries	Apr 1957
3	Tidal Flow in Entrances	Jan 1960
4	Soil as a Factor in Shoaling Processes, a Literature Review	Jun 1960
5	One-Dimensional Analysis of Salinity Intrusion in Estuaries	Jun 1961
6	Typical Major Tidal Hydraulic Problems in United States and Research Sponsored by the Corps of Engineers Committee on Tidal Hydraulics	Jun 1963
7	A Study of Rheologic Properties of Estuarial Sediments	Sep 1963
8	Channel Depth as a Factor in Estuarine Sedimentation	Mar 1965
9	A Comparison of an Estuary Tide Calculation by Hydraulic Model and Computer	Jun 1965
10	Significance of Clay Minerals in Shoaling Problems	Sep 1966
11	Extracts from the Manual of Tides	Sep 1966
12	Unpublished Consultation Reports on Corps of Engineers Tidal Projects	Dec 1966
13	Two-Dimensional Aspects of Salinity Intrusion in Estuaries; Analysis of Salinity and Velocity Distributions	Jun 1967
14	Tidal Flow in Entrances; Water-Level Fluctuations of Basins in Communication with Seas	Jul 1967
15	Special Analytic Study of Methods for Estuarine Water Resources Planning	Mar 1969
16	The Computation of Tides and Currents in Estuaries and Canal	Sep 1969
	Appendix A: A User's Manual	Jun 1973
17	Estuarine Navigation Projects	Jan 1971
18	History of the Corps of Engineers Committee on Tidal Hydraulics	Jun 1972
19	A Field Study of Flocculation as a Factor in Esturial Shoaling Processes	Jun 1972
20	Unsteady Salinity Intrusion in Estuarines	
	Part I: One-Dimensional, Transient Salinity Intrusion with Varying Freshwater Inflow	Jul 1974
	Part II: Two-Dimensional Analysis of Time-Averaged Salinity and Velocity Profiles	Jul 1974
21	Evaluation of Numerical Storm Surge Models	Dec 1980

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